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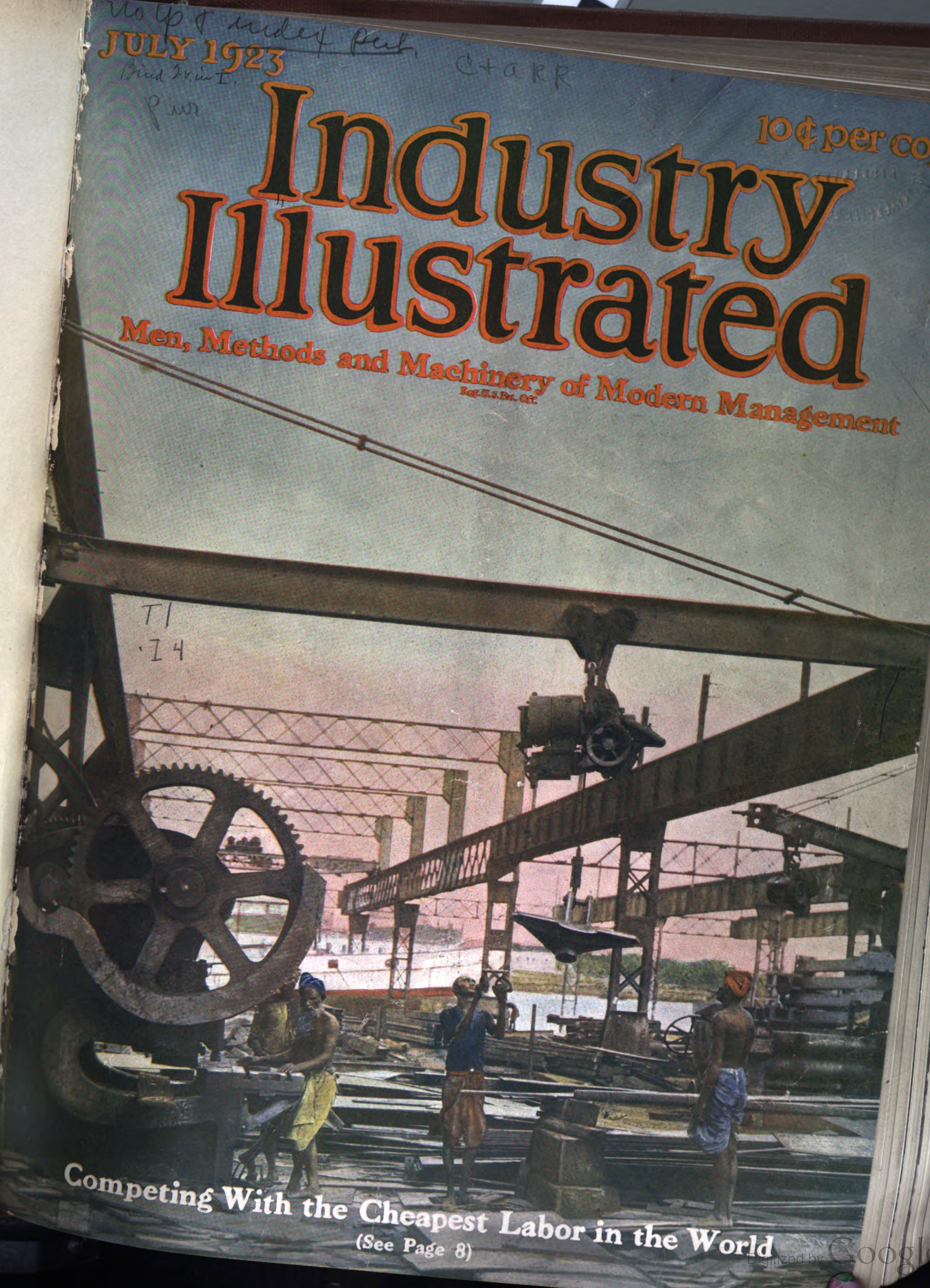
JULY 1923

Industry Illustrated

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Men, Methods and Machinery of Modern Management

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Competing With the Cheapest Labor in the World

(See Page 8)

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Reducing Handling Costs

To reduce material handling costs use Hyatt roller bearing equipped trailers: they run easily, reducing storage battery strains and eliminating noonday boosting; they operate for three or four months on one application of grease; they give years of hardest service without requiring bearing adjustment or bearing replacement.

Trailers, Hyatt roller bearing equipped, are made by:

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7. Sharon Pressed Steel Company
8. Warren & Irrgang Company

Hyatt Roller Bearing Company
Newark, N. J.











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INDUSTRY ILLUSTRATED

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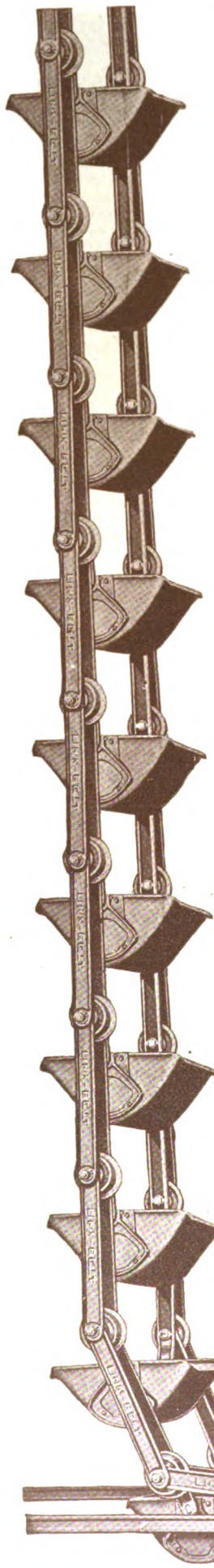
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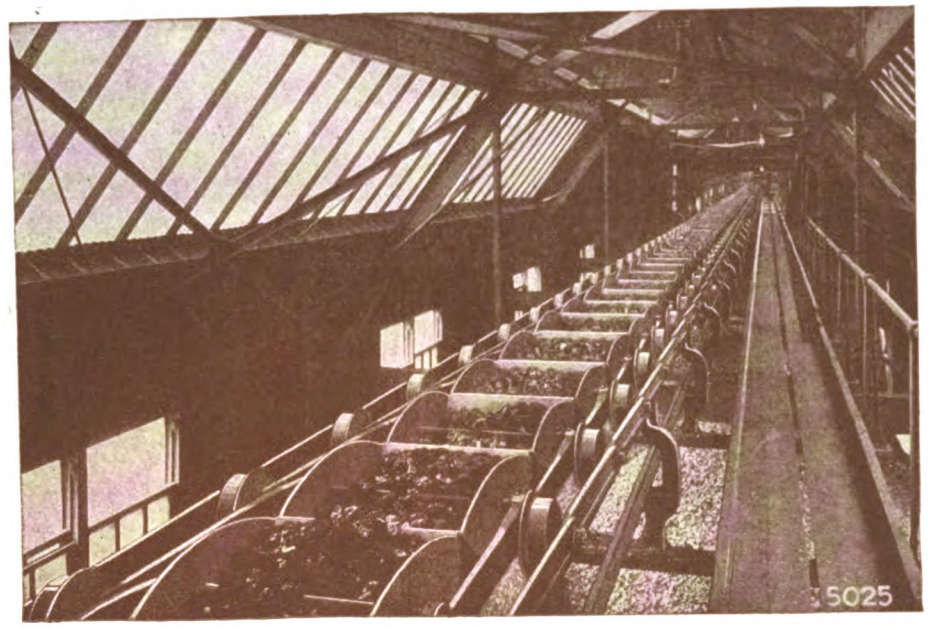
Speeding a Barrel Elevator by a Special Automatic Feeder

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The Peck Carrier for Handling Both Coal and Ashes

ONE sturdy reliable unit, instead of several inferior machines for accomplishing the same results.

Handles both coal and ashes with less upkeep than required for individual machines for coal and ashes.

Costs practically the same as elevators, conveyors, skip hoists and other equipment required to do same work—and is more dependable.

Operation and maintenance is less than for any other types of coal and ashes handling apparatus.

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Back of the Peck Carrier stands the reputation of this company—with hundreds of successful installations. Full particulars in Catalog 220.

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He may do it—
but the chances are he won't—and you pay

THIS workman, No. 38, started Job No. 530 on the milling machine at 8:24 A. M.

He has just finished (2.12 P. M.) and is trying to calculate the actual time spent on the job (*the elapsed time*).

He must deduct thirty minutes for lunch.

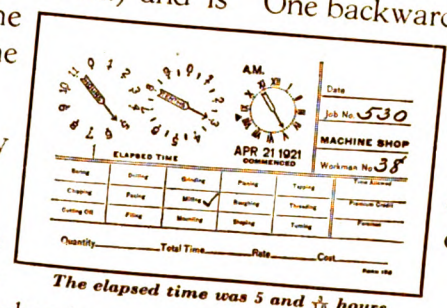
He may do it but it is a tedious operation, it takes him away from his productive work and the result will probably be incorrect.

The Calculagraph would give the answer instantly and accurately

The Calculagraph computes and prints *elapsed time* in hours and minutes or hours and tenths. It prints the starting time and date, also the finishing time and date. It makes records for any number of employees.

The Calculagraph will take cards of various sizes and shapes furnished by any printer. It operates very simply.

One backward-forward movement of the right hand Calculagraph lever when the job starts, a pull on the left-hand lever when the job is done, and the time record is complete.



The elapsed time was 5 and 1/10 hours

The Calculagraph is practically tamper-proof

The Calculagraph is as nearly tamper-proof as a machine can be. The records cannot be falsified as shifting the hands of the clock will not in anyway change the *elapsed time* recording mechanism.



Calculagraphs have an eight day spring driven movement with jewel balances. There are no wiring or electrical connections to give a high maintenance cost or difficulty in moving.

Imprints are made from metal type through ribbon that is easy to insert and which reverses automatically.

The Calculagraph weighs only eighteen pounds yet it is durable—constructed to withstand hard usage in power houses, manufacturing plants, etc. It is absolutely guaranteed.

"Elapsed Time Records"

This is the title of a booklet which contains valuable time-keeping information. Those interested in labor cost and payroll records may have a free copy upon request.

Calculagraph Company

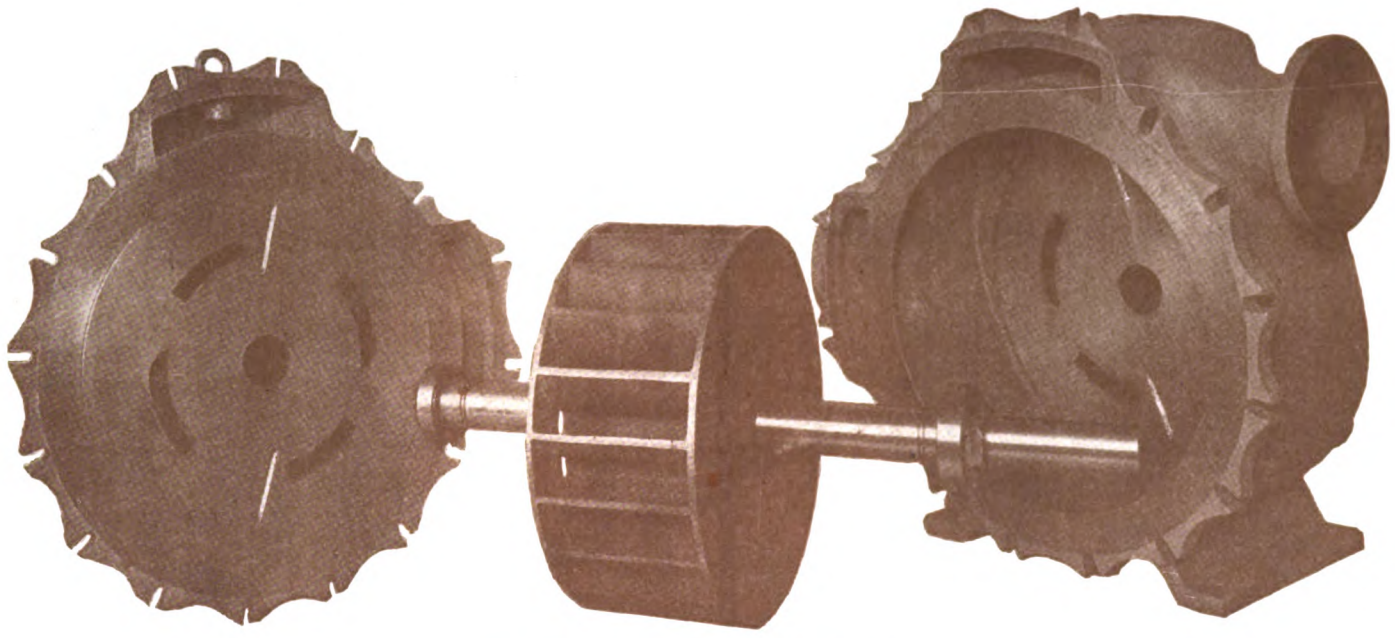
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THE ECONOMICAL AIR COMPRESSOR AND VACUUM PUMP



ALL THE PARTS OF THE HYTOR

THE HYTOR COMPRESSOR is valveless, has no gears, loose moving or reciprocating parts, no piston packing to renew, no cylinders to lubricate, and no bearing adjustments to make.

The rotor, the only moving part, is cast in one piece, the blades being rigidly reinforced by shrouds. The rotor is mounted on a short, stiff shaft supported at each end by the highest grade annular ball bearings mounted outside of the casing.

As the peripheral clearance is large, there is no possibility of the ends of the rotor blades coming in contact with the casing.

The original high efficiency is maintained indefinitely in continuous service.

The air is thoroughly washed during compression and contains no oil.

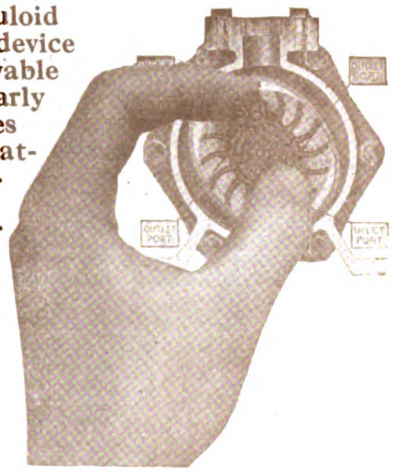
Hytor compressors occupy very much less floor space and are much lighter in weight than reciprocating compressors.

They run without vibration.

The cost of installation is greatly reduced as no expensive foundations are necessary.

No expert attendance is required as there are no adjustments to make. The cost of upkeep is negligible.

Hytor compressors are quiet in operation.

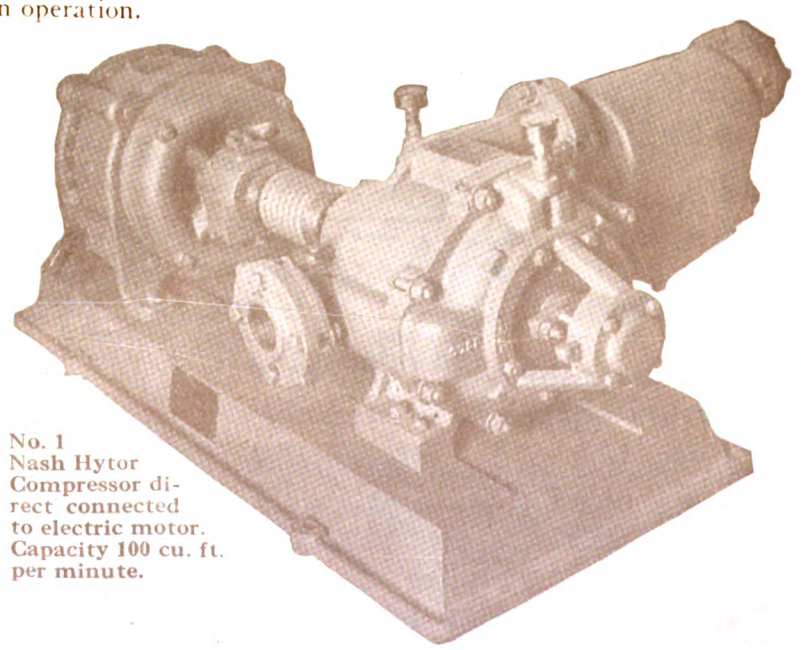


This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.

At pressures up to and including 15 lbs. per square inch, and vacuums up to 20 inches of mercury, the Nash Hytor affords the simplest and most economical means for handling air or gas, for all of the usual purposes where air under pressure is required, and they can be used on many special services for which the ordinary compressor is not adapted.

It is common practice in handling mildly acid vapors to re-circulate thru the pump an alkaline solution for the protection of the cast iron structure of the pump. In handling chlorine gas, concentrated sulphuric acid is re-circulated.

Air handled by the Hytor is delivered absolutely clean and free from dust or oil; a great advantage in the agitation of good products or in absorption processes where diffusion of air is accomplished by blowing thru filters, porous blankets or small orifices.



No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

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EDITORIAL

Our Great Store of Common Labor

RECENT newspaper headlines have driven home to most of us the fact that in this country there is a very real and growing shortage of common labor. There may be a vast gulf between New York's twelve-dollar-a-day bricklayers and, for example, the four-dollar-a-day common laborer in the steel industry. Yet this gulf is as nothing compared to that between the wages of common labor in this country and in China or India; for the coolie laborer receives only about ten cents a day—or roughly, one-fortieth of what his American prototype demands.

At first thought, there would seem to be an obvious connection here: On the one hand, America, with a shortage of common labor; on the other, China, India—and to a lesser degree, the European countries—with a vast surplus of laborers accustomed to low wages. But let us look behind this immediate picture for a moment.

In no other country has industrial progress reached as high a state of development as in the United States. In the production of automobiles, of tools, of steel, of machinery, this country leads the world. But in another, and vastly more important respect too, this country leads the world:—in the scale of living of the worker. And this last—most important because it is of benefit to the greatest number—is only true and only possible because American labor, through the use of machinery and mechanical power, is more productive than labor anywhere else in the world.

At the extreme opposite end of the scale, India and China, with their teeming millions and with untold wealth in natural resources, are today less advanced, industrially, than America was fifty years ago. Coolie wages, at best, suffice only to ward off starvation. The vast majority of the population in the Orient exist in a state of pitiful wretchedness.

Some of our manufacturers, fascinated by the idea of "cheap labor," would have this country lift the present immigration restrictions—would admit hordes of foreign laborers, irrespective of any danger to our established institutions—as a solution to our labor shortage.

There is a confusion of terms here. We do need more common labor; but it is not more *human* labor that we need—it is a greater use of our store of *accumulated* labor. To import cheap and inefficient labor would merely result in lowering the average productiveness of labor in this country; and inevitably that would carry with it a lowered standard of living for the worker.

For the past seven or eight decades, American ingenuity has been transforming unskilled workers into skilled or semi-skilled workers. Machines of almost uncanny ability have lightened the labor of individual workers, and at the same time have so increased their productive power as to make this labor more valuable.

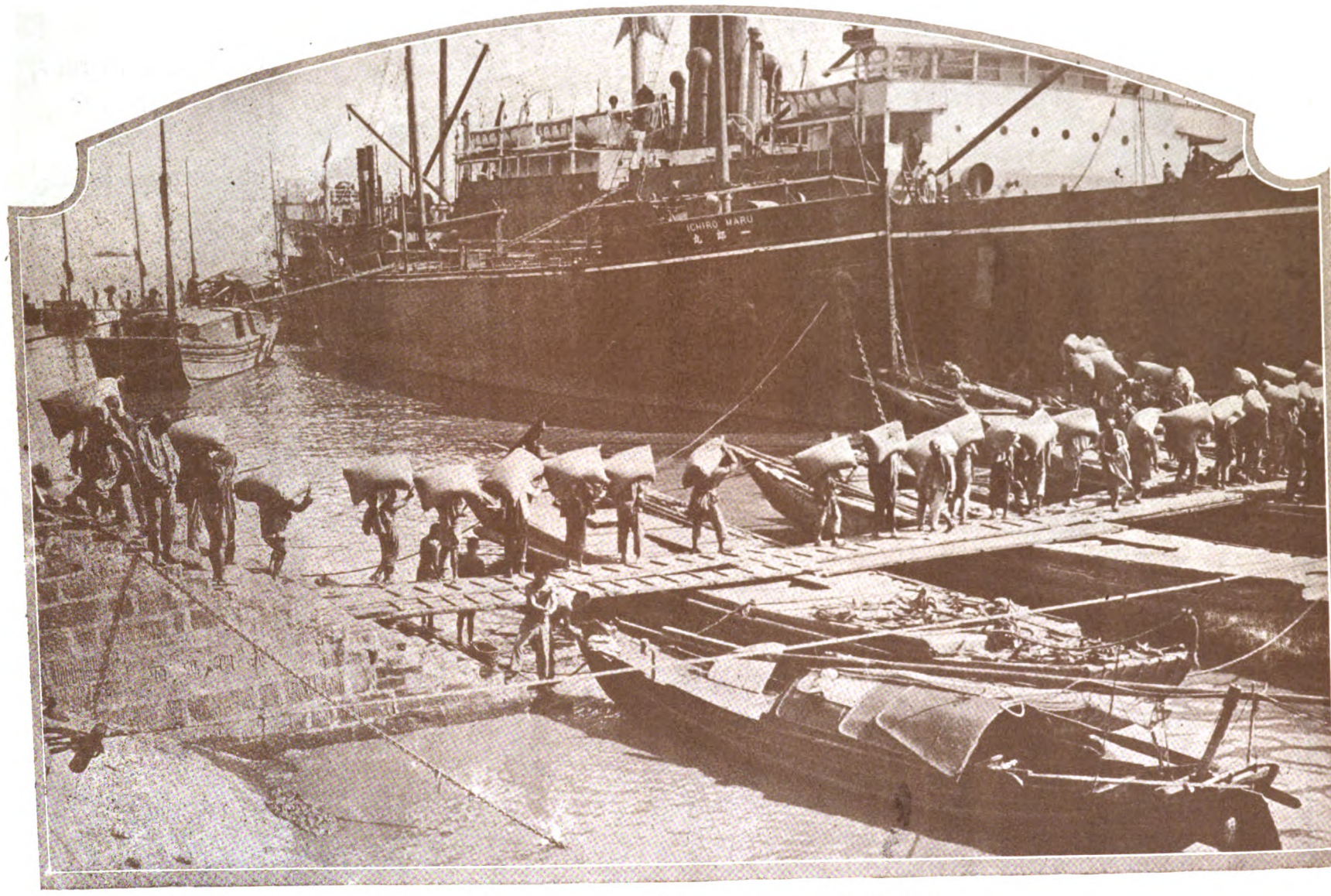
What many of us fail to appreciate is, that this process has become cumulative: a portion of the increased productiveness has gone to the worker; a portion has gone to the employer; but by far the greater portion of this increased productiveness has gone into machinery which makes ever lighter the labor burden of succeeding generations. And it is this *stored up labor* —tireless, cheap, efficient, labor-saving machinery—that must perform the common labor, now, and increasingly in the future.

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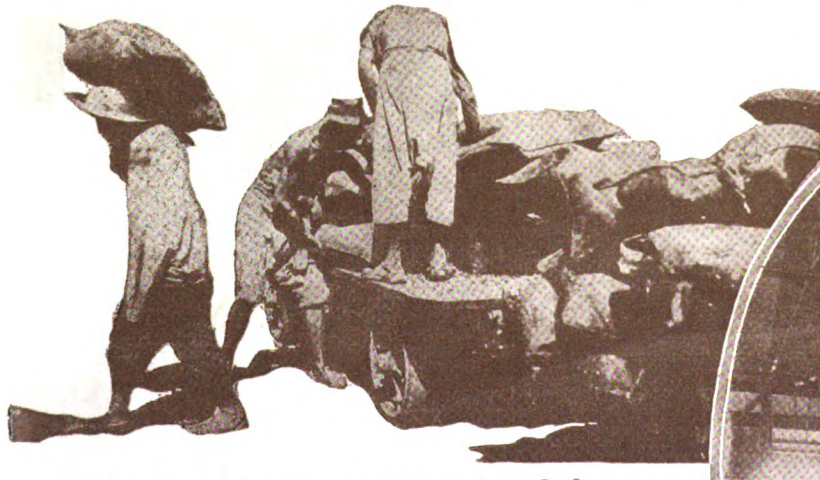
Competing with the Cheapest

Materials Handling

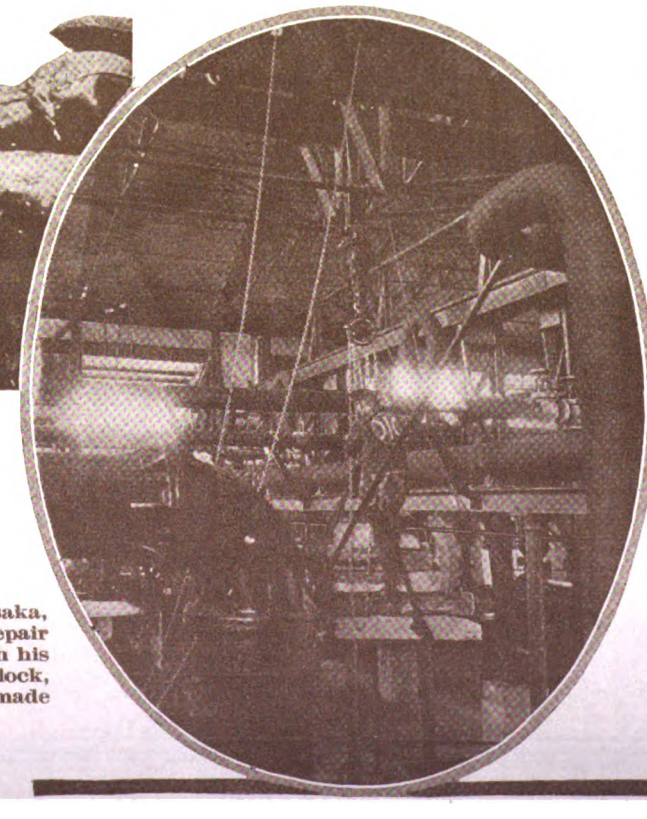
By F. C.



Loading bags of seed at Hankow, 10 bags to the ton, at the rate of a ton a minute by coolie power. On short hauls, modern materials handling equipment cannot meet this competition.



On long hauls, however, such as from dock to distant warehouse, or to delivery point, the industrial truck and trailer puts the coolie out of the running.



In the Municipal Water Works at Osaka, Japanese prisoners are used to do the repair work. Note the Jap prisoner rides with his load on an American-made chain block, which is suspended from an American-made hand-operated traveling crane.

IN the Far East, no such thing as a labor shortage is known and consequently with plenty of labor available and to be had at the rate of a few cents a day, it might seem, at first thought, to be ridiculous for American manufacturers to expend any effort in cultivating what is apparently such unproductive territory.

Taken as a whole, the Far East is a poor territory in which to try to introduce the Occident's conception of materials handling. But, in the large sea-port cities, despite the plentitude of common labor and its cheapness, there is a real place for the use of mechanical handling devices. The application of this equipment has been recognized, as was to be expected, by American and European trained engineers, and much of the equipment has been introduced as a result of their missionary work.

In applying the use of indus-

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apest
Handling

By F. C.

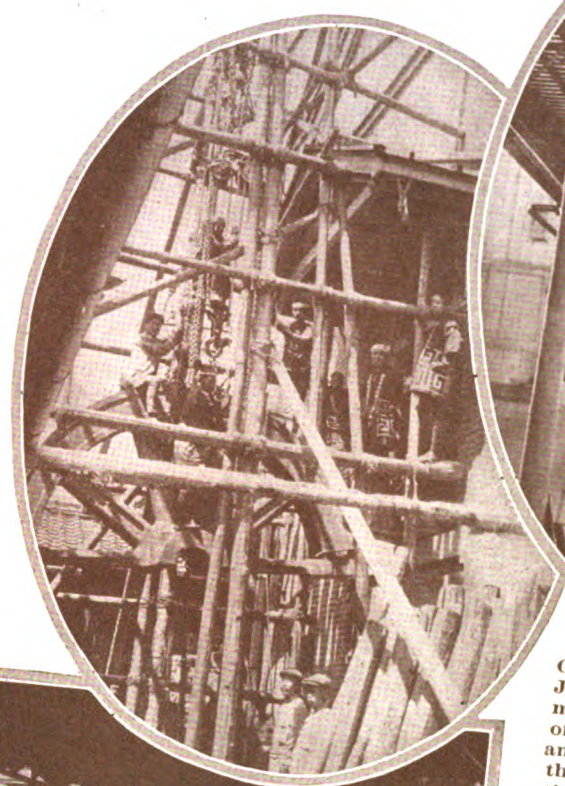
Labor in the World
in the Orient

By Eibell

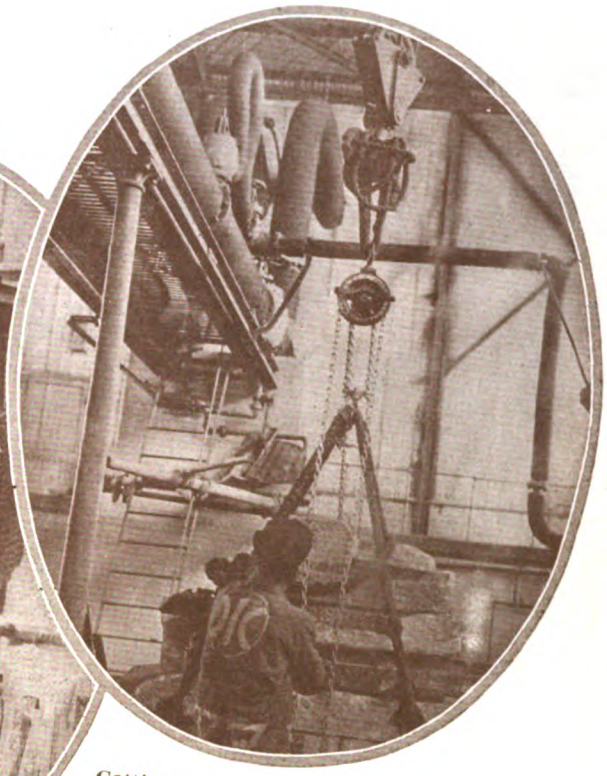
trial trucks to Chinese warehouse and dock conditions, the two places where this equipment has met with success in use, we must keep in mind the fact that Chinese roadways are very poor. In fact, they do not know how to build roads and it is necessary to teach them not only how to operate and care for an industrial truck but also how to build a road for it to operate on. It has been found profitable for these users to lay a new and complete system of roads around the warehouses. Thus the trucks are enabled to perform their work with the greatest efficiency. However, even where good roads were not available, industrial trucks proved their value for hauling heavy loads over distances of several hundred yards.

In the construction of the foreign settlement in one of the suburbs of Shanghai an American platform industrial truck with six trailers entered into competition with coolie labor. It was used to haul concrete, 350 pound baskets of mud, and from six to eight coolies on each trip. It traversed the roughest of ground with complete reliability and unusual speed. Its loads averaged about 9,000 pounds and it covered a dis-

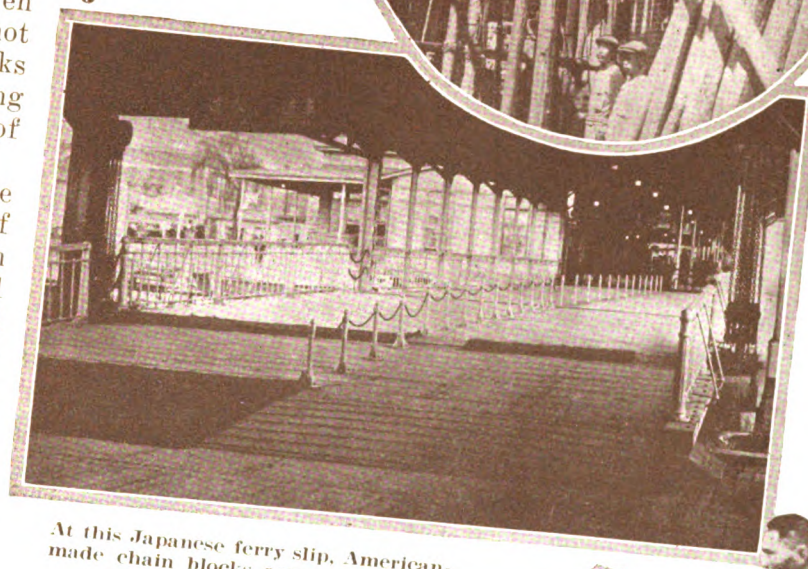
(Continued on page 45)



A contrast of the Occident and the Orient. Japanese workmen built this wooden rig, braced with bamboo poles and tied, not nailed, together. The huge casting is being lifted into place by means of a chain block of American manufacture.



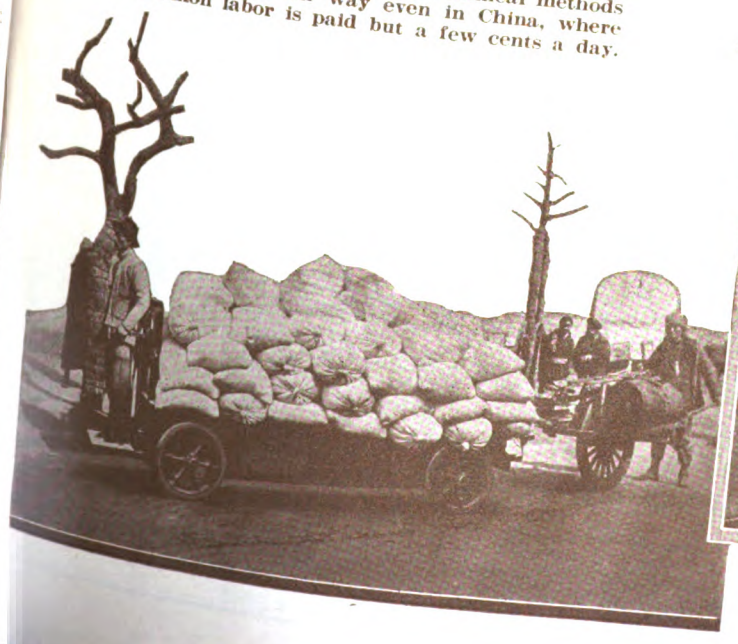
Getting ready for a masonry job. This Japanese prisoner is using an American-made chain block. This is another view of the Municipal Water Works at Osaka and contrasts the American methods with those of the Japanese. You can distinctly see the bracings lashed together with heavy cord at the left, behind the load of stone.



At this Japanese ferry slip, American-made chain blocks are used to raise and lower the gang plank.



A loaded American-manufactured industrial truck competing with coolie labor in the shadow of the world-known exporting house of Mackenzie & Co. The truck carries 4,000 pounds—the coolies 200 pounds each.



Somehow, there is something incongruous to our occidental eyes, in a scene such as this. It is worth studying, however, if it helps to drive home the idea that mechanical methods are winning their way even in China, where common labor is paid but a few cents a day.



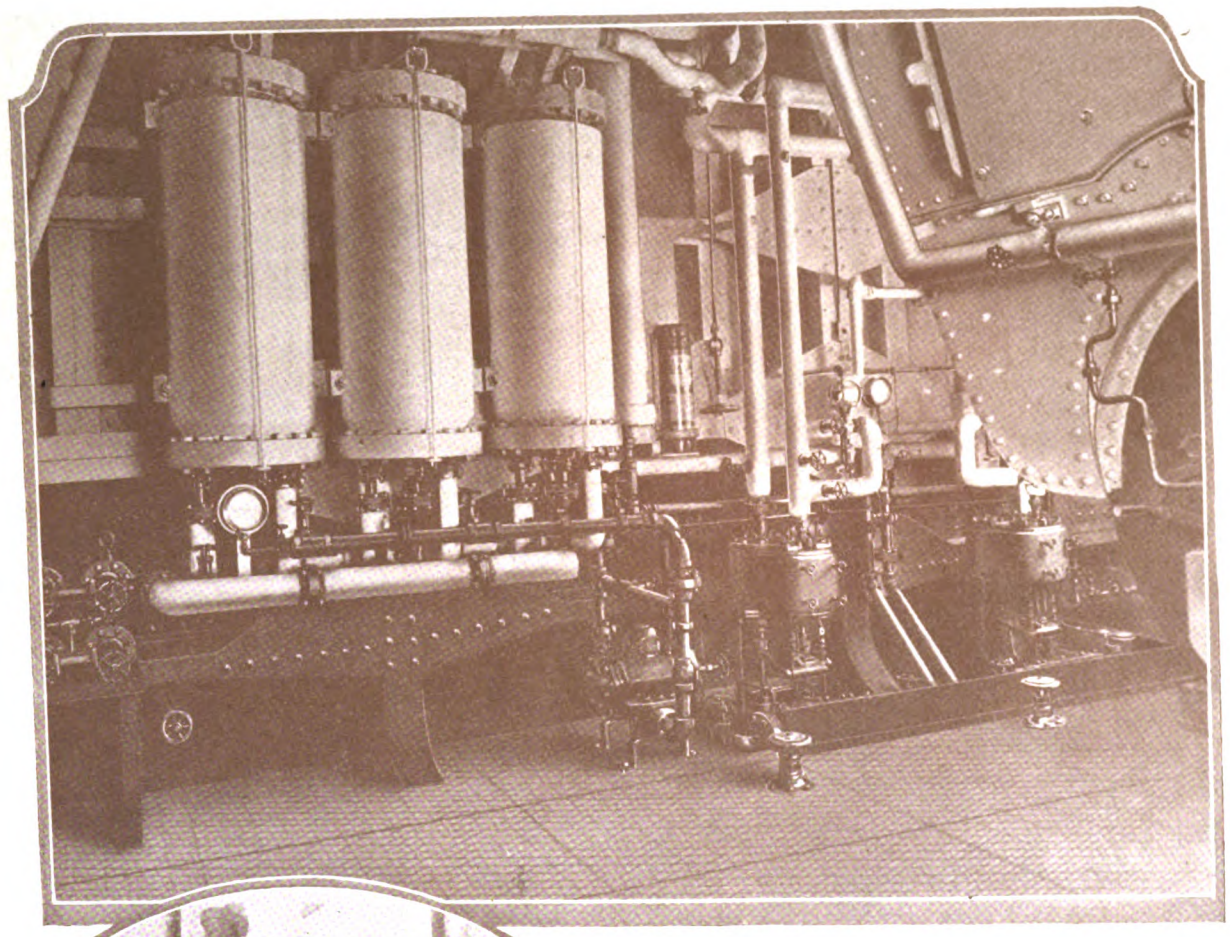
The sons of the Prophet operating an American-built electric hoist, in this Indian shipyard. (Another view of this yard is shown on our cover.)

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The Why and How of Pre-Heating Fuel Oil

Auxilliary Equipment that has Revolutionized Oil Burning

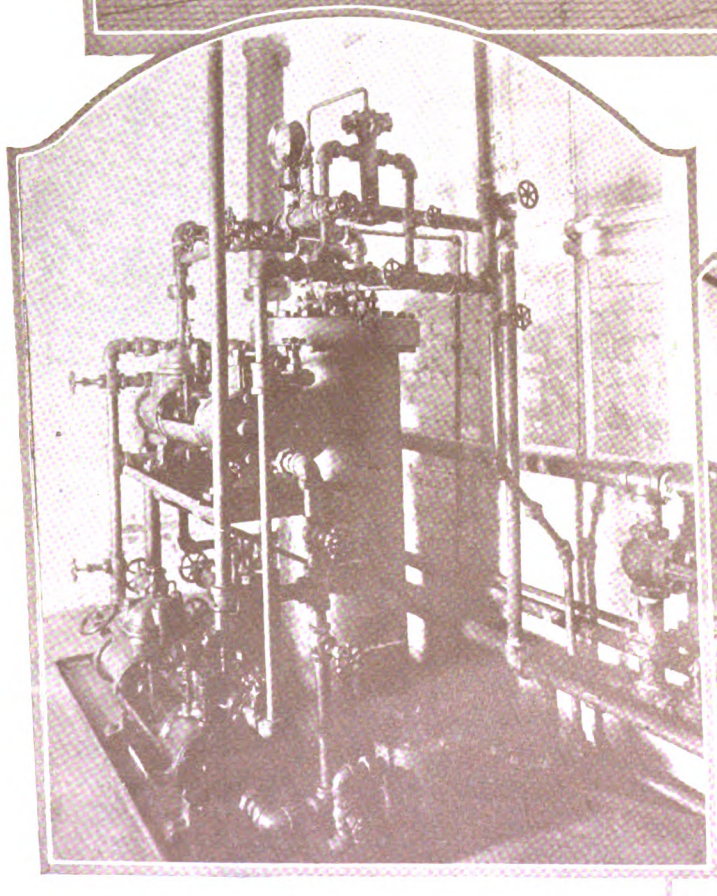
ALLEN F. BREWER



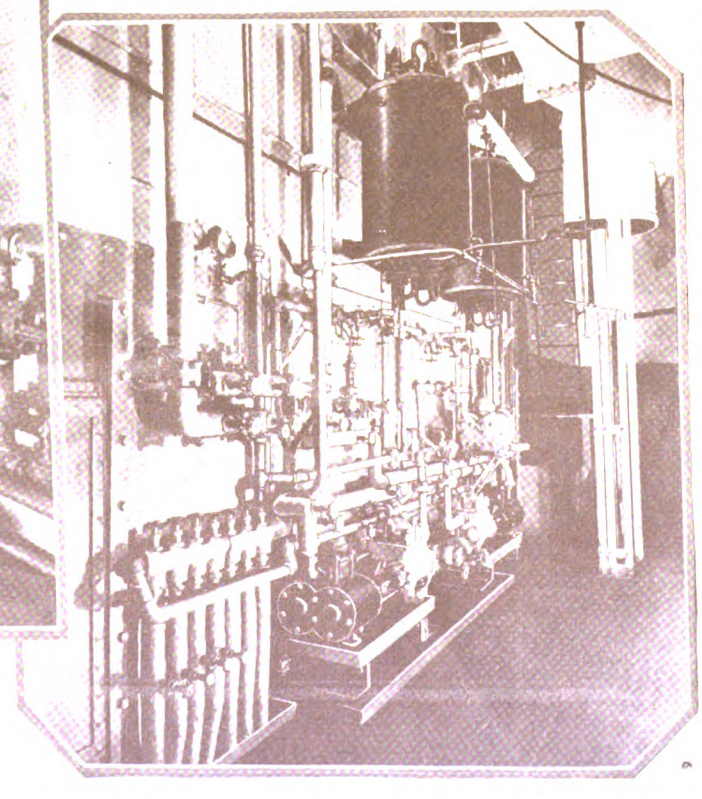
Series of three coil type fuel oil heaters installed for marine service.

OVER the past twenty years the use of fuel oil for industrial, stationary and marine purposes has been developed from an embryo experimental stage to a veritable science, and a multitude of equipment has been perfected to bring about the most complete combustion possible. In fact it may be safely stated that it is chiefly due to modern firing and handling apparatus such as burners, heaters, pumps and strainers, that fuel oil has attained its enviable reputation as being the ideal fuel of the industrial world today. Relatively speaking, fuel oil requires more preliminary treatment than coal before it can be fired. For example, it must be strained, pre-heated, raised to a certain pressure and atomized in order to bring about proper combustion.

Of the above steps, pre-heating has perhaps the most bearing upon combustion efficiency. No matter how perfected the burner may be it will be prac-

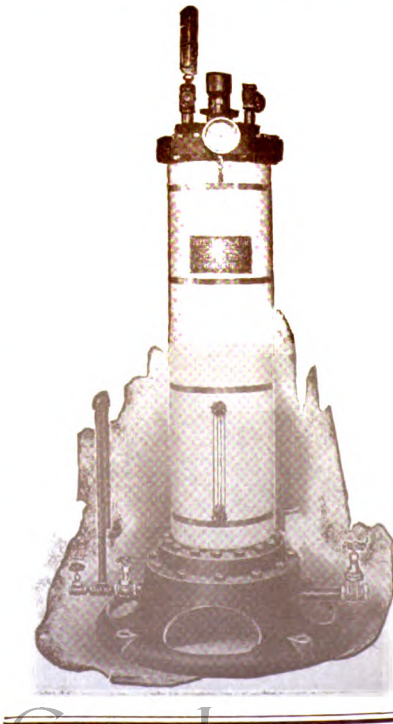


Fuel oil pumping and heating set installed for stationary service. Especial compactness of equipment is attained by installing the heater vertically.

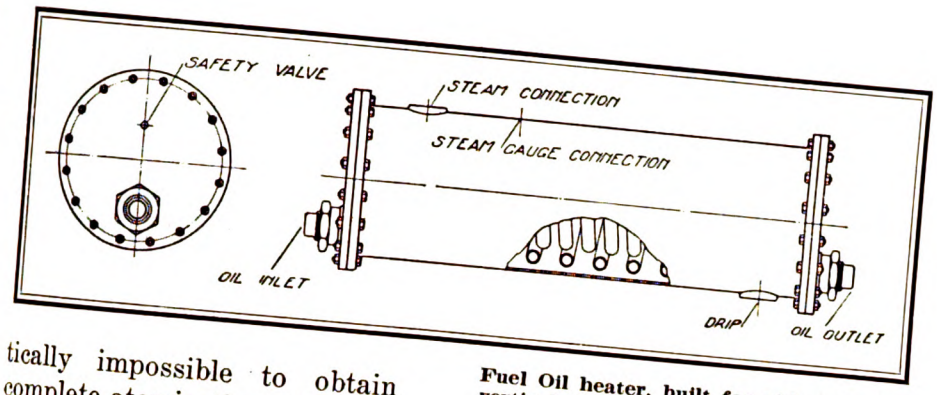


Installation of coil type heaters on board a 12,000-ton freighter. In this plant the heaters are located overhead, above the pumps, in order to conserve space in the fireroom as much as possible.

Vertical type of fuel oil heater showing necessary attachments such as thermometer, pressure gage, and connections. Live and exhaust steam are admitted to the coil through suitable inlets at the top, while the oil enters at the bottom. Thus counterflow of the oil and steam is obtained.



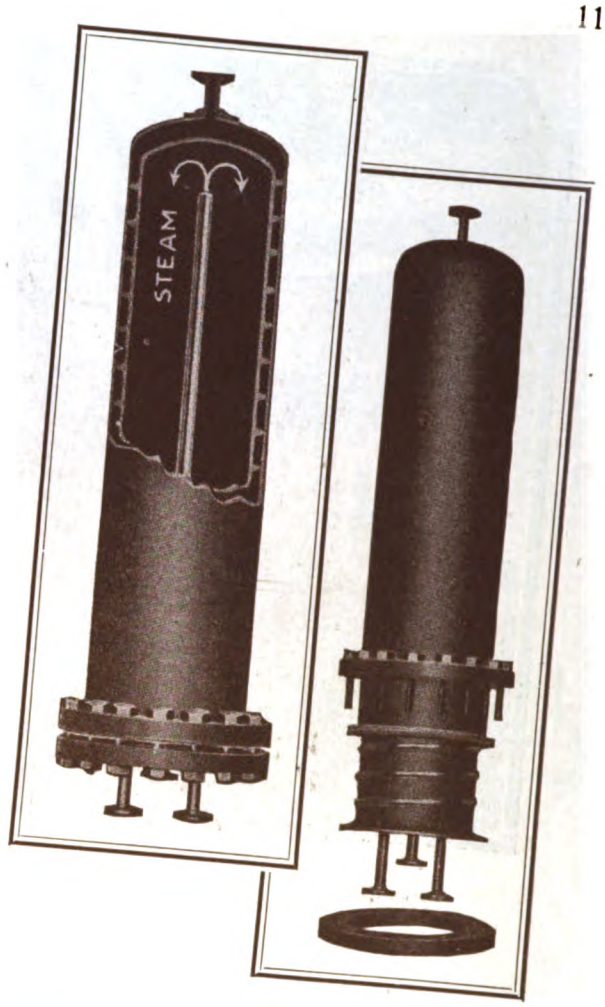
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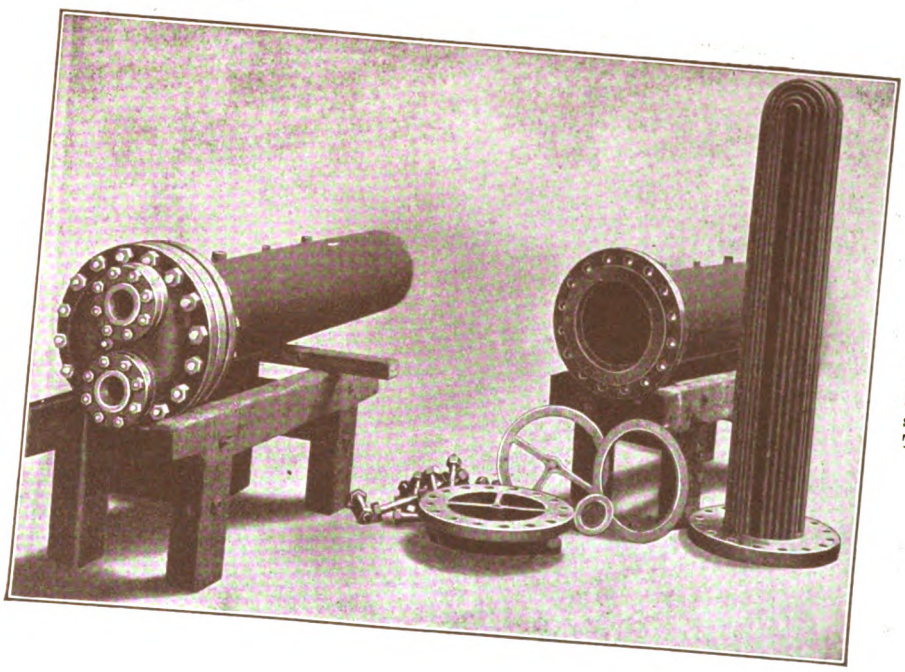
Fuel Oil heater, built for either horizontal or vertical installation. All steam and oil joints are external, the heating element being an endless coil of wrought iron or steel pipe, or seamless steel tubing.

tically impossible to obtain complete atomization of the oil if it is not properly heated. Likewise, pumping will be affected inasmuch as, if the oil is not sufficiently heated, it may become so sluggish as to flow intermittently and cause a decrease in fuel delivery to the burner. Another result of insufficient heating will be an excess of smoke due to incomplete combustion. Too high an oil temperature will, on the other hand entail unsteady burning of the oil due to pulsation, frequent carbonization of the oil both at the burner tip and in the oil piping directly in back of the burner, and oftentimes serious damage to the boiler setting, baffles and tubes.

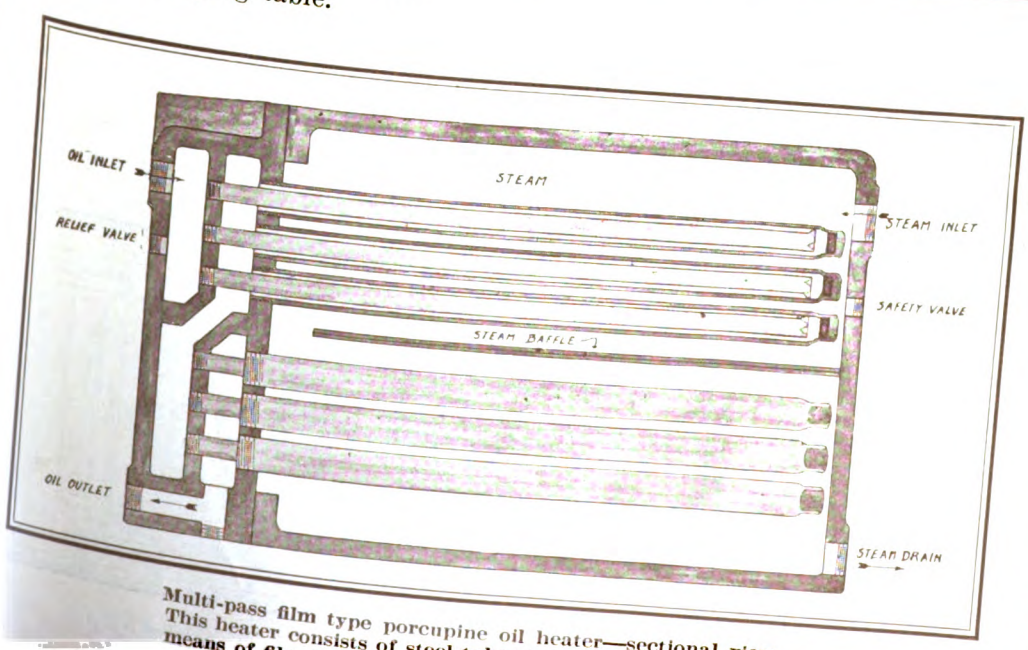
The extent to which fuel oils should be pre-heated will depend largely upon their Baumé gravity and viscosity. In fact it is the opinion of authorities that there is a theoretical temperature for every grade of oil, according to its above characteristics at which maximum atomization will be possible at the burner. Many experiments have been carried out in this regard and considerable data compiled. Within certain limits this can be condensed to the figures shown in the accompanying table.



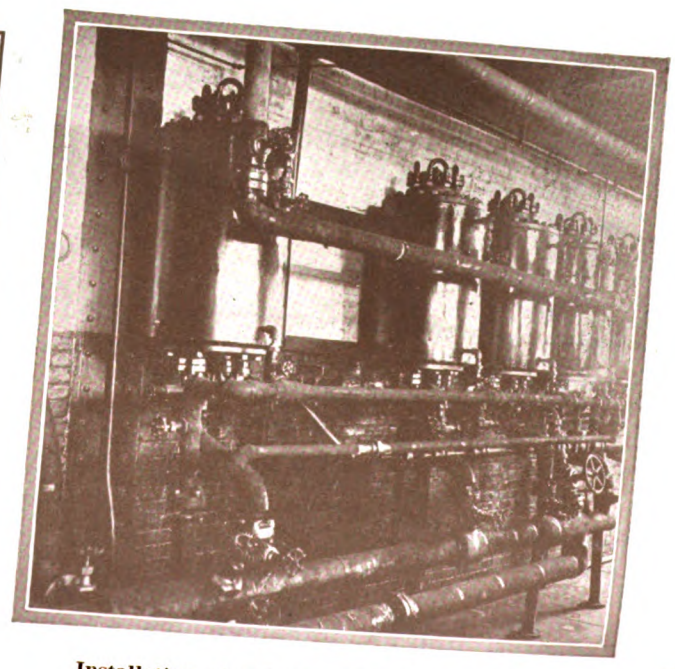
Cone spiral film type of pressed steel cleanable fuel oil heater. The features of this heater are that there are no copper coils to be attached by sulphur in the oil; and the shell is of pressed steel thus affording maximum strength with minimum weight.



This heater usually operates with the oil inside the tubes, the steam being passed through the shell and surrounding them. This is a form of multi-pass return tubular heater.

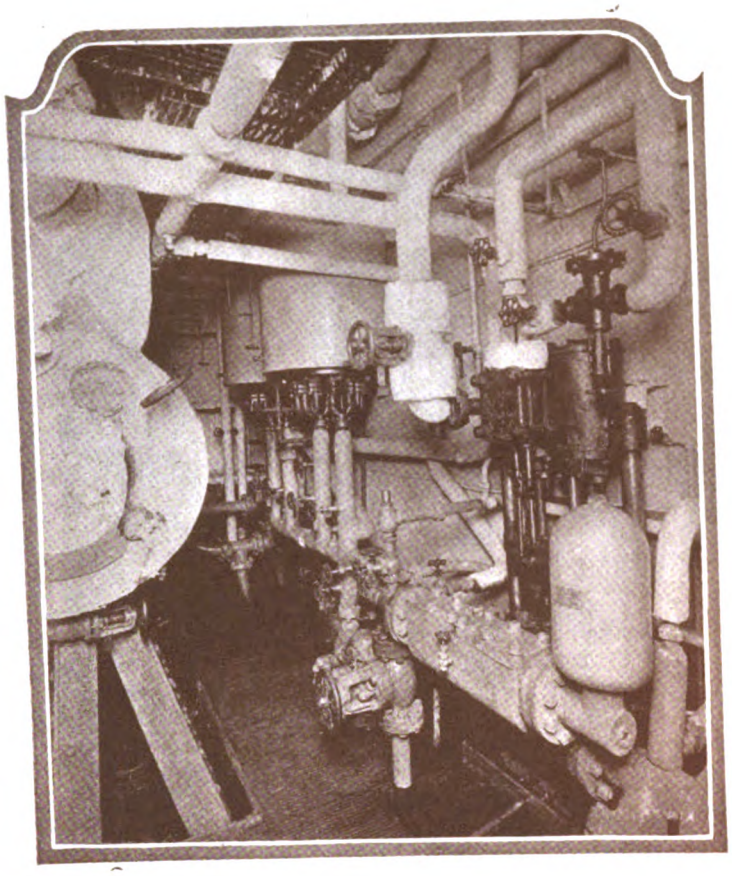


Multi-pass film type porcupine oil heater—sectional view. This heater consists of steel tubes in a cast iron shell. By means of film heating and the multi-pass effect maximum heat transfer per unit of surface is obtained.

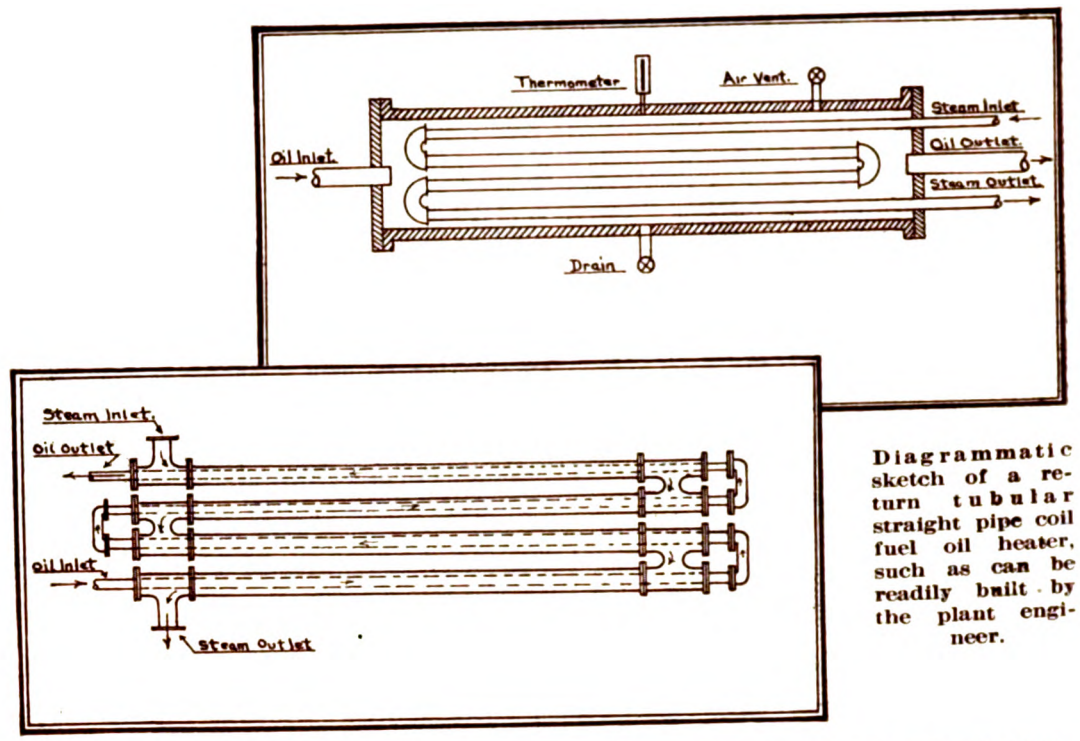


Installation of coil type oil heaters in Quincy Point Power House of Eastern Massachusetts Street Railway Company.

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Installation of coil type oil heaters on board S. S. Pan America.



Diagrammatic outline of a double pipe coil fuel oil heater.

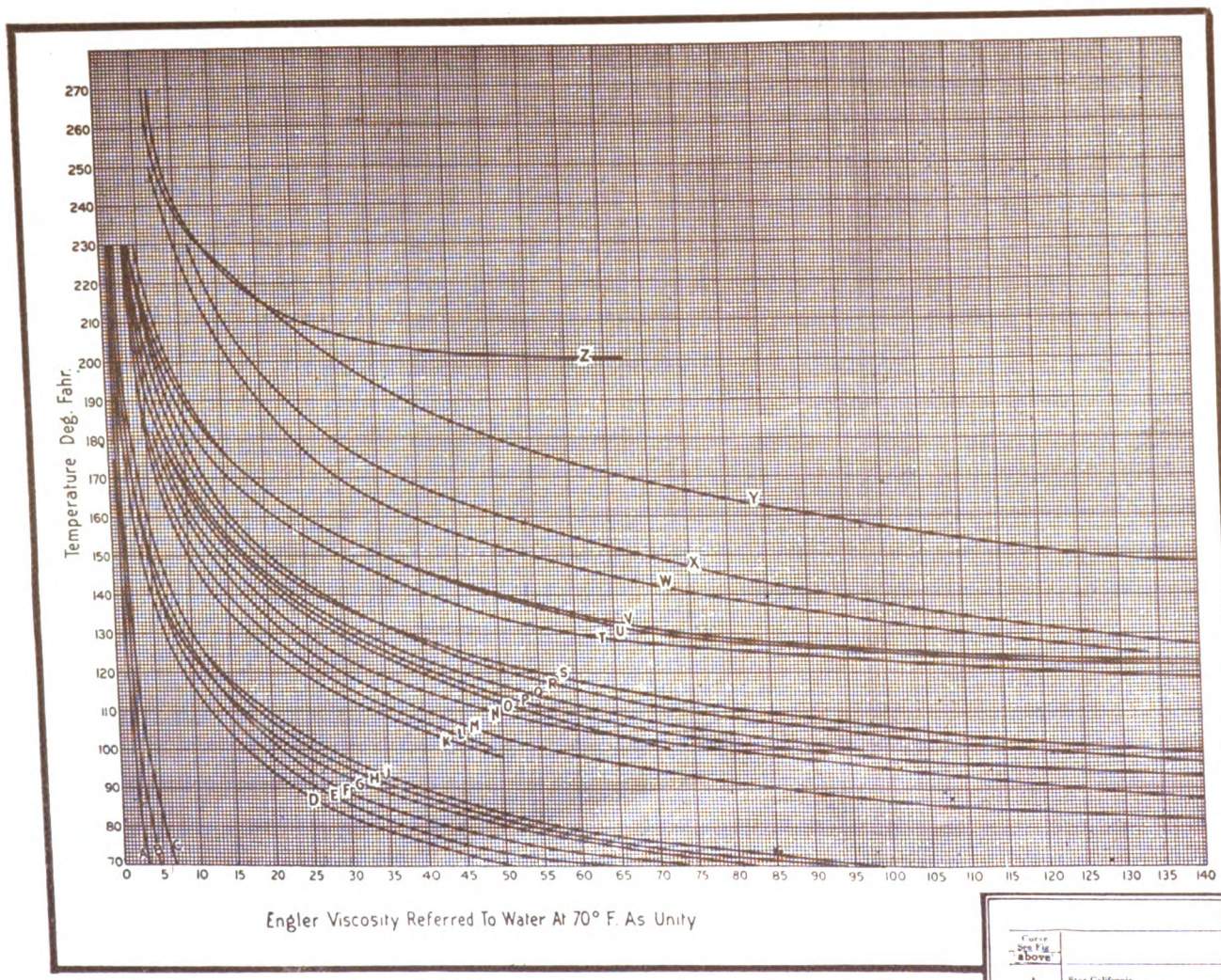
Diagrammatic sketch of a return tubular straight pipe coil fuel oil heater, such as can be readily built by the plant engineer.

TABLE OF GRAVITIES AND CORRESPONDING PRE-HEATING TEMPERATURES

Baumé Gravity	Temp. Deg. F.
10-12	280-300
12-14	270-280
14-16	250-270
16-18	200-240
18-20	170-200
20-24	160-170
24-28	150-160
28-35	140-150

While heavier oils such as Mexican crudes, and certain grades of topped fuel oils, which originally contained a low percentage of lighter products such as gasoline and kerosene, will in general require a relatively high degree of pre-heat, there is little or no danger involved. Such oils may frequently require heating above their flash points, but due to the slight amount of lighter products which they contain which would have a tendency to flash at lower temperatures, there will be scarcely any possibility of fire occurring. In marine practice, however, even the slightest fire hazzard must be guarded against hence it is customary to observe the rule of never heating above the flash point of the oil.

The development of the fuel oil heater from the crude re-

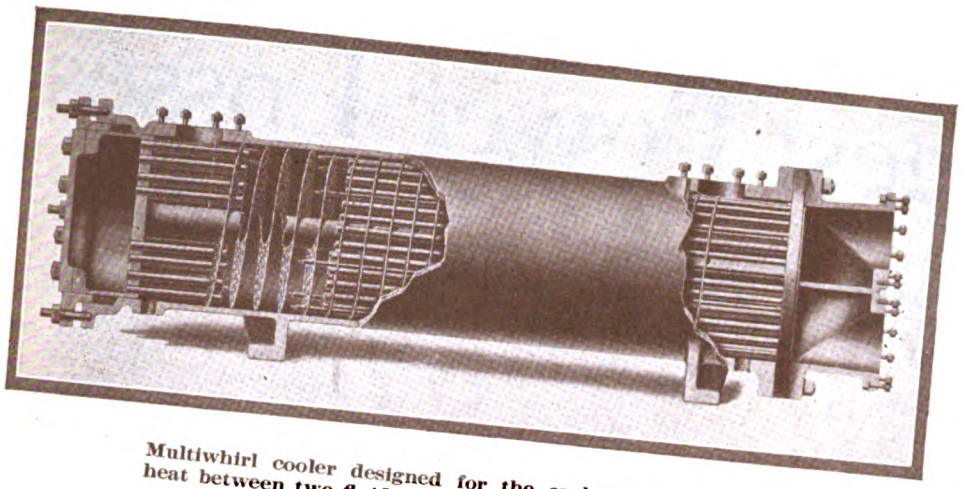


Viscosity-temperature curves of more usual grades of heavy fuel oils as specified in table shown on the right.

PROPERTIES OF HEAVY FUEL OILS

Curve See Fig. above	Source of Oil	Deg. Baume	Flash Point Deg. Fahr.
A	Star California	23.9	180
B	Standard Indiana	29.6	144
C	Standard Illinois	27.2	146
D	Sun Co. Louisiana	19.8	275
E	Avon Refinery Associated Oil Co., California	17.1	168
F	Coalinga Field Associated Oil Co., Monterey, California	16.5	186
G	Richmond, California	17.1	228
H	Oleum Residuum No. 2 Fuel Oil, Union Oil Co., Calif	18.5	174
J	Producers Crude No. 1 Fuel Oil, Union Oil Co., Calif	16.1	188
K	Nos. 1, 2 and 3, Anglo Mexican Petroleum Products Co.	16.8	
L	Mexican Oil From U. S. S. Arethusa	17.6	182
M	Texas Co. Reduced Mexican Crude	17.3	162
N	Standard Mexican Crude	17.0	145
O	Sample No. 2, Anglo Mexican Petroleum Products Co.	16.2	238
P	Gaviota Refinery Associated Oil Co., Calif	17.1	230
Q	Sample No. 3, Anglo Mexican Petroleum Products Co.	17.3	184
R	Texas Co. Mexican Crude	17.3	126
S	Standard Mexican Crude	15.4	262
T	No. 25 Union Oil Co., Bakersville, Calif	13.2	280
U	No. 102 Union Oil Co., Bakersville, Calif	12.9	
V	No. 18 Union Oil Co., Bakersville, Calif	12.9	285
W	Toltec Or Panuco Oil, Inter Ocean Oil Co., N. Y.	12.6	220
X	Toltec Fuel Oil, Inter Ocean Oil Co., N. Y.	11.7	180
Y	Inter Ocean Oil Co., High Flash Heavy Crude	10.26	374
Z	Mexican Residue	10.0	

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Multiwhirl cooler designed for the exchange of heat between two fluids. Internal construction is clearly shown.

turn tubular ideas of a decade ago to the numerous patented devices on the market today is interesting in the extreme. Essentially the effort has been throughout to improve upon the rate of heat transfer. With this end in view the film type of heater which brings the steam in contact with one or both sides of the oil piping, the endless coil heater and the multi-pass type are striking examples. It is evident that the greater the area of heating surface within reasonable limits of container size, and the more thorough the mixing of the oil particles, the more efficient heating will be obtained with the least amount of steam. Either live or exhaust steam can be used in a fuel oil heater. Where lower temperatures only, are necessary, it will usually be possible to use exhaust steam from the oil pumps. When heavier oils are used, however, requiring heating above about 200 deg. F. it will be best to use live steam.

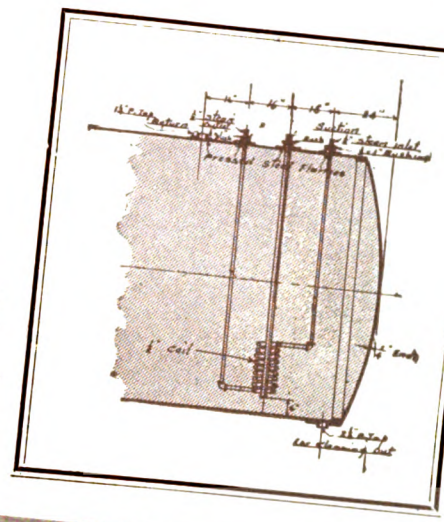
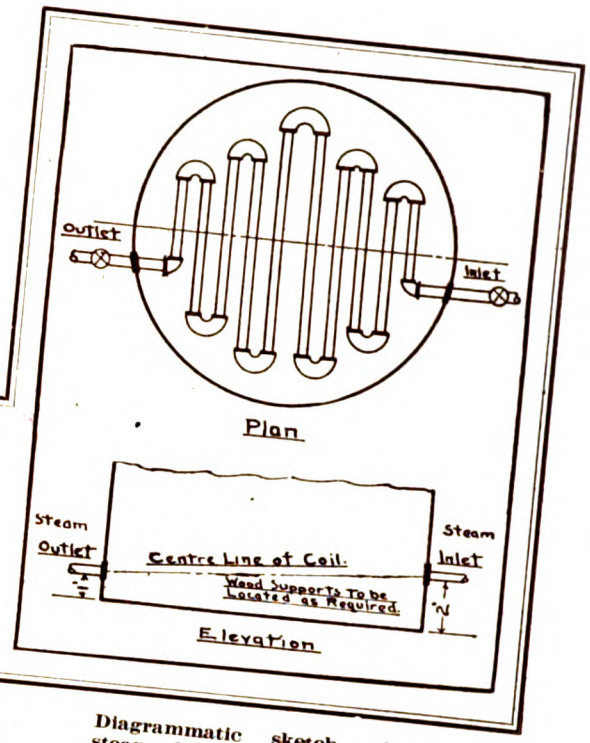
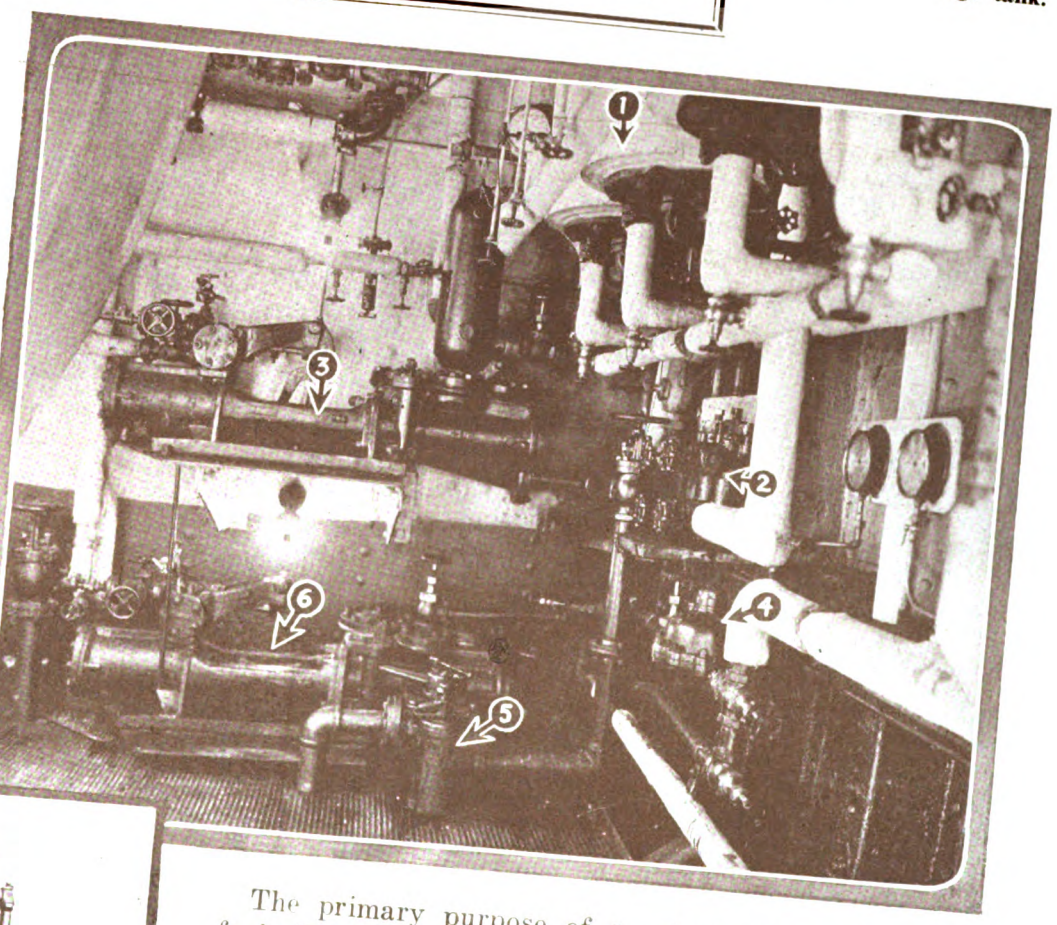


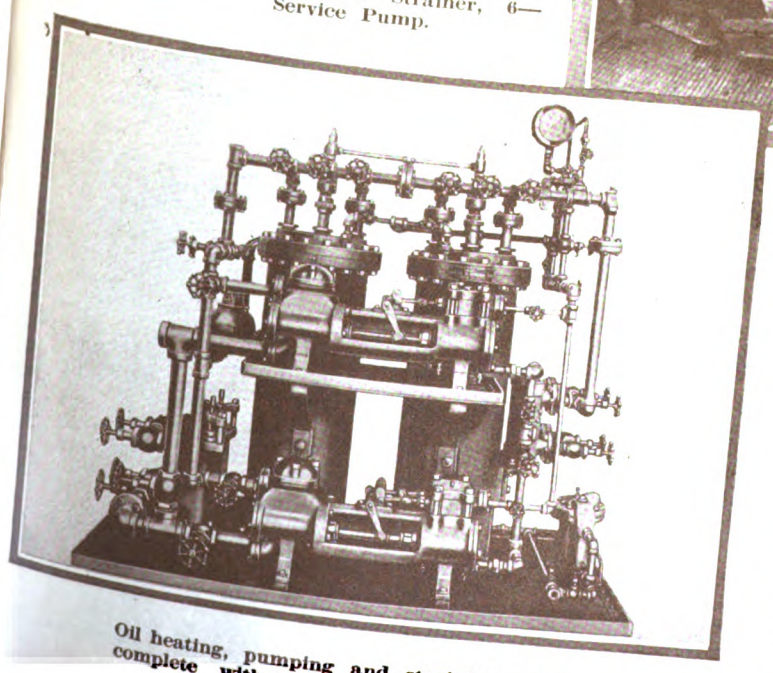
Illustration of the method of heating fuel oil at the suction inlet in a horizontal oil storage tank. In this arrangement a small steam coil is placed in the storage tank surrounding the inlet to the suction pipe.



Diagrammatic sketch of a steam heating coil arrangement for installation in the base of a vertical fuel oil storage tank.



Installation of coil type oil heaters on board S. S. Paul Luckenbach. 1—Oil Heaters, 2—Discharge Strainer, 3—Service Pump, 4—Meter, 5—Suction Strainer, 6—Service Pump.



Oil heating, pumping and straining outfit complete with connections, valves, and gage, etc.

The primary purpose of a fuel oil heater is to reduce, to a varied extent, the sluggish condition that the oil may be in, due, if a heavy crude, to its naturally high viscosity and low Baumé gravity; or, if a residual fuel oil, to either a high viscosity or to cold weather, or both combined. Whatever the cause of such a sluggish condition, it nevertheless must be reduced in order that the oil may be enabled to flow normally freely, with fair rapidity, as little pulsation as possible and without clots, etc. Thus only will we insure a constant stream to the burners, and hence continuous atomization, all other factors being properly conditioned. This result can only be obtained by the application of heat to the oil. This latter should not be applied, however, to such an extent as to render operating conditions dangerous, but only in sufficient amount to reduce the viscosity and attain the desired flow. In best practice this heat is applied by means of steam coils, located in the main fuel oil storage tank, or by some form of standard fuel

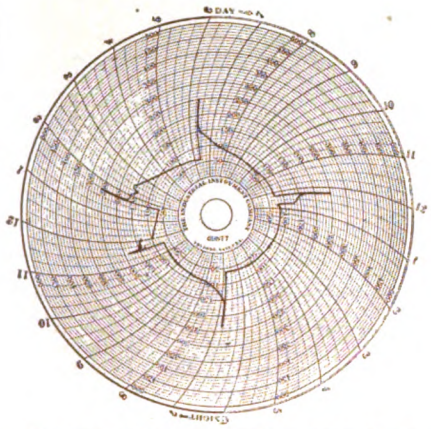
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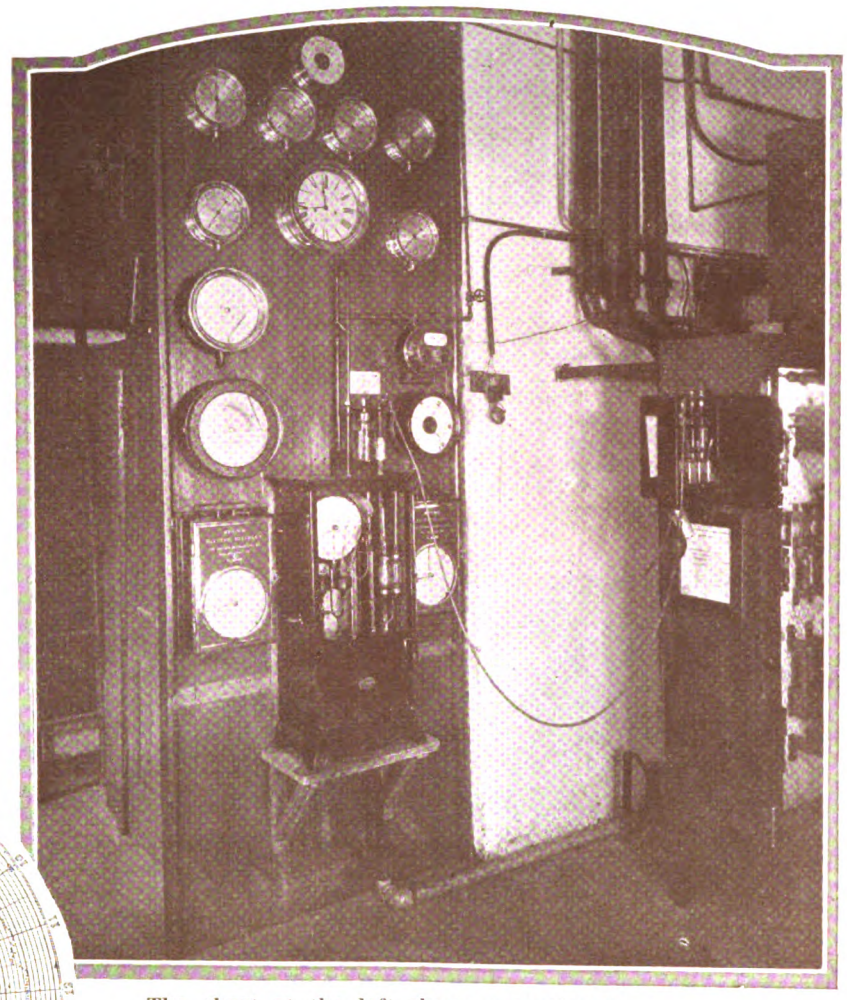
Stopping the Biggest Power Losses

Practical Combustion Suggestions for the Average Plant

BY JAMES T. BEARD, 2nd



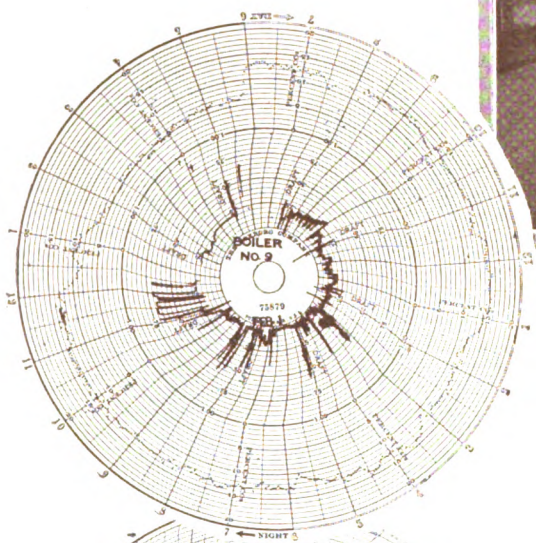
Record obtained with recording thermometer with bulb located in blow-down line of the boiler. This method is often used to check the number of times the boilers are blown down every day. Opening the blow-off valve increases the temperatures, in the line and registers on the chart. In the case there were five blow-down periods.



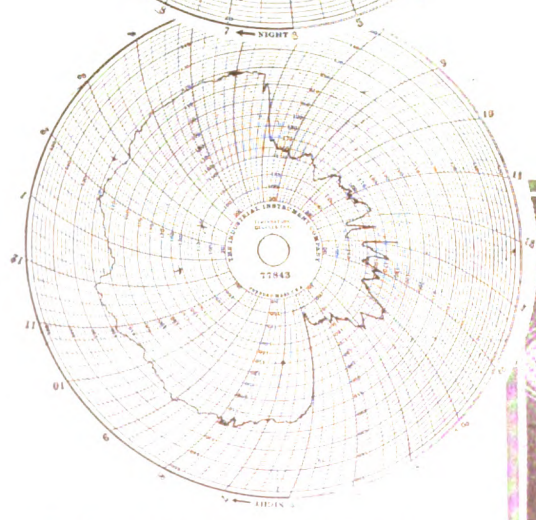
HAVE you ever seen the chief walk down the firing floor, pull open a door here and there, look into the furnace, using his hand to shield his eyes from the glare, and remark, "That's a good fire"? From years of experience he has trained his eye to detect spots in the fuel bed and, as a rule, he is a good judge of combustion efficiency, basing his conclusions solely upon his personal observations.

In boiler house operation, however, there are many little leaks, heat losses we call them, which cannot be observed by a casual inspection of the fires. Such losses are not spotted until the superintendent calls the

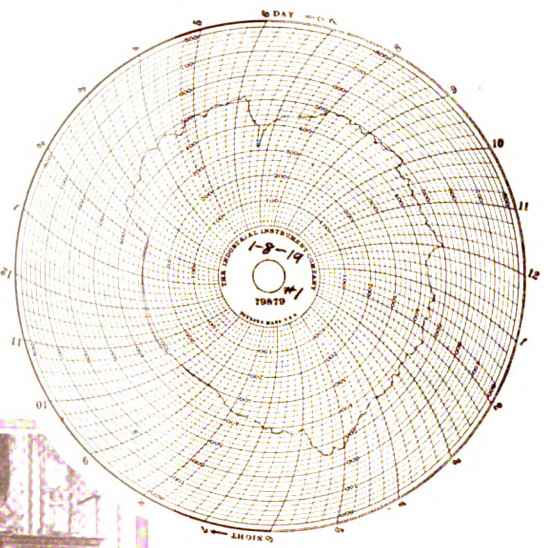
At the left—A typical instrument board in a small boiler plant, furnishing continuous records of plant operation and economy. With such equipment it is always possible to detect the sources of loss and to take proper steps to stop them. These intruments also warn the chief the instant that his heat units are getting beyond his control.



The chart at the left shows a continuous record of the percentage of CO_2 giving an indication of the amount of excess air, in the flue gases leaving the boiler. CO_2 recorders similar to this are among the most valuable instruments in the boiler house for detecting heat losses. The chart shows that the fires were banked from midnight until 6 a. m.



At the right—Sample of chart showing temperature record of flue gases leaving the boiler. These gases should not greatly exceed 550 deg. F. During the night when the fires are banked the temperature is correspondingly low.



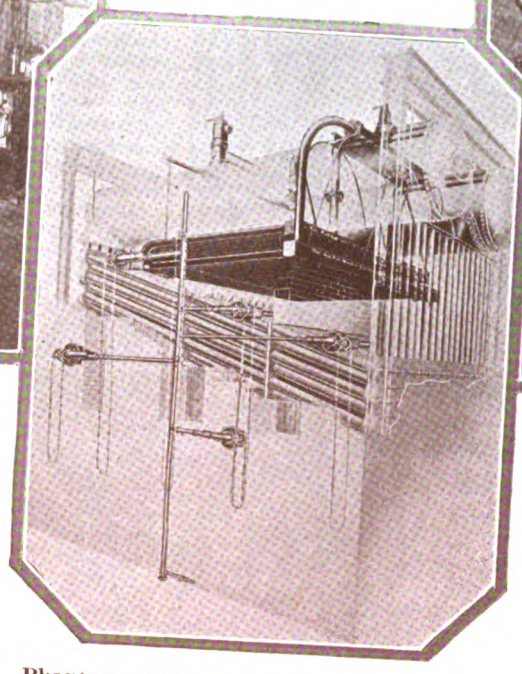
A battery of instruments for what is evidently a 4-boiler installation. In this case each boiler is provided with a separate CO_2 recorder and a separate steam flow meter, indicating the combustion efficiency and the capacity developed by each individual unit.

Feed water thermometers — although not properly classed as combustion appliances—are valuable in indicating the cleanliness of feed water heaters and their efficiency of heat transfer.

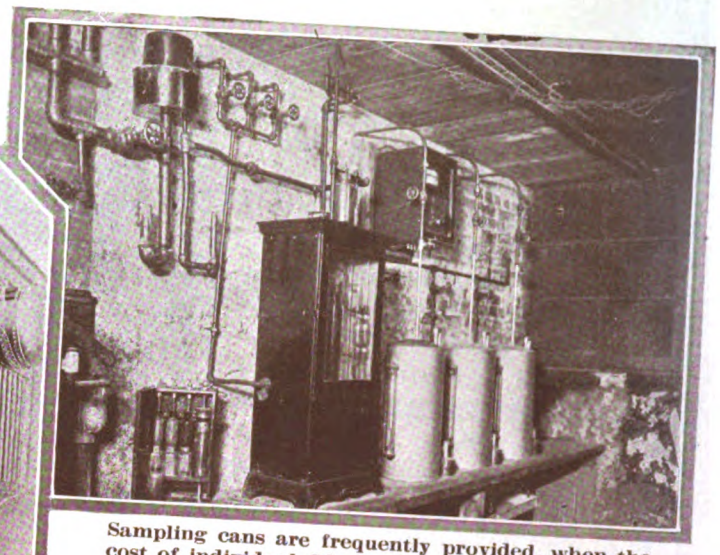
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This complete instrument equipment in the office of the chief engineer makes his private sanctum resemble the pilot house of a ship and provides him with instant and continuous information that enables him to guide his plant along a safe and economical course. The instruments include steam flow meters, CO_2 recorders, flue gas pyrometers, feed water thermometers and a hand orsat for periodically checking the accuracy of the CO_2 recorder. Note the charts filed on convenient pegs on the chief's desk. These instruments accomplished a saving of 2,000 tons of coal a year in this plant.



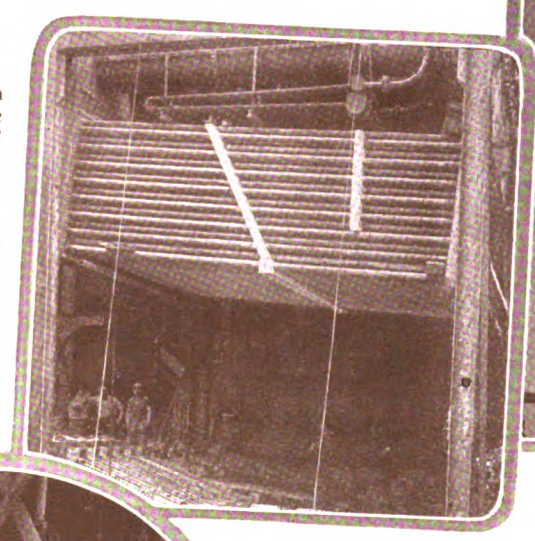
Phantom view of a boiler and setting, showing the location of permanently installed soot blowers. Such appliances are essential for scouring the soot deposits from the external surfaces, thereby increasing the capacity of the boiler.



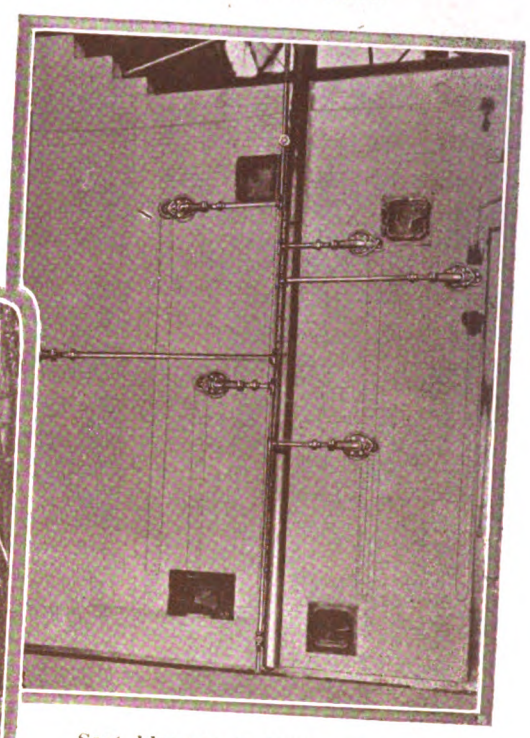
Sampling cans are frequently provided, when the cost of individual CO_2 recorders for each boiler is prohibitive. These cans collect average gas samples over a period of time and, when used in conjunction with a CO_2 recorder in the main flue afford valuable information on average daily operations. The collected gas samples are tested daily with a hand orsat in a few minutes and the figures recorded for each boiler.

chief into the office at the end of the month to explain why the coal record showed a big jump last month. And the chief is at a loss to explain. Perhaps he puts the blame on a poor run of coal, faulty grates, leaky baffles, poor draft control. But he has no knowledge, based upon records, that enables him to put his finger on the weak spot and say, "There's the trouble, and as long as you insist on buying 22-per cent. ash coal, we are going to have the same trouble."

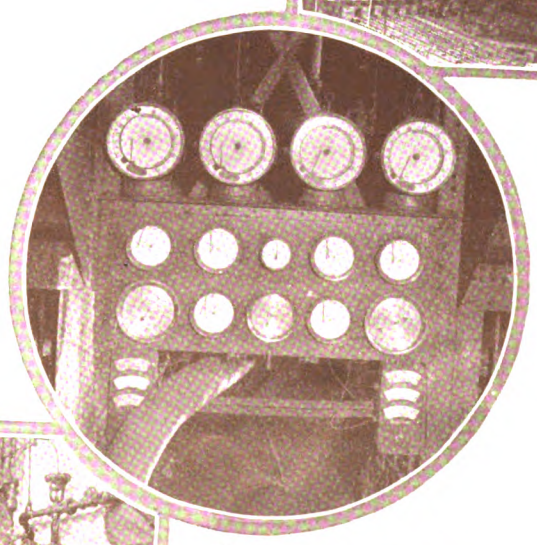
Compare this chief with his brother who sits at his desk, from which he directs the operation of a similar power plant. Records for the previous 24 hours of operation are placed before him and he



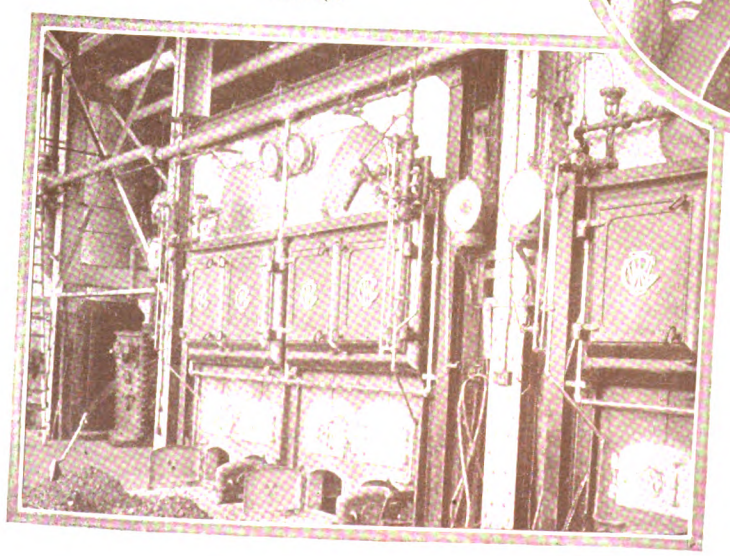
How baffles are located in some types of water tube boilers for the purpose of deflecting the gases across the tube banks 3 or 4 times before they leave the boiler. The shortcircuiting of hot furnace gases through cracks and leaky baffles is one source of heat loss and high flue gas temperature, which must be avoided.



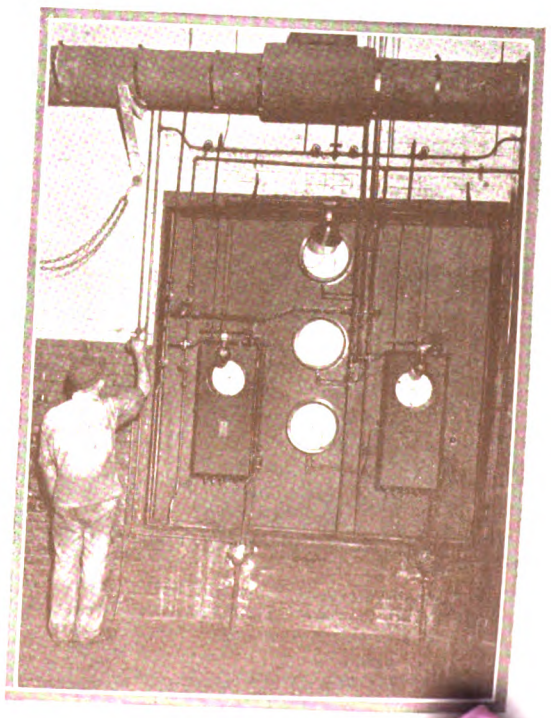
Soot blowers as they appear from the outside of the boiler setting. Steam is turned into the blower unit while it is slowly revolved by pulling the continuous chains. Soot and slag deposits are thus scoured from the tube surfaces.



Even in small hand-fired plants it has been found profitable to install individual flow meters on each boiler, at the same time keeping careful records of the amount and quality of coal burned. Surprising economies have often been effected by this small outlay.



Above—A battery of flow meters, thermometers and indicating draft gages in a large industrial plant boiler house. Because of the resemblance to other boiler house instruments, indicating draft gages have in some cases been very successful in winning the appreciation of the boiler room force



At the right—A compact type of CO_2 recorder which also affords accurate and continuous records, indicating the amount of excess air and preventable waste in the flue gases. The fireman is in the act of opening the gas sample line to one of the boilers.

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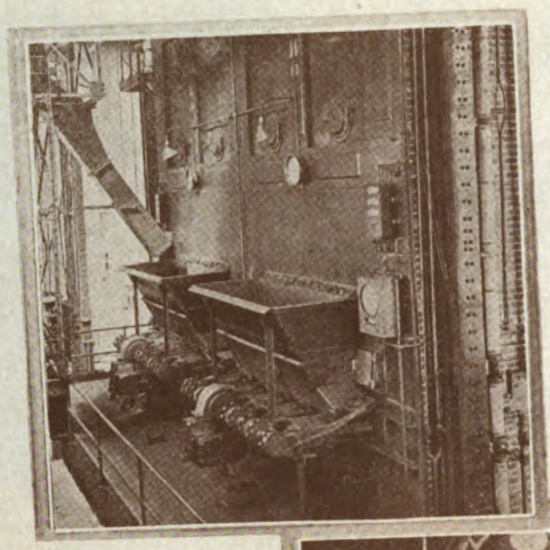
studies them closely. "Looks like that front baffle in No. 3 has broken through," we hear him remark. "That's a job for this Sunday. Guess I'll have to get Pete to coach that green fireman on No. 5; he don't seem to get the hang of it, judging from his charts for the past few days."

At the end of the month he, too, is called in to the superintendent's office. "How's this, Bill?" the big boss says. "I've got you down for 1,800 tons of coal last month. That's a jump of 350 tons of coal over the month before."

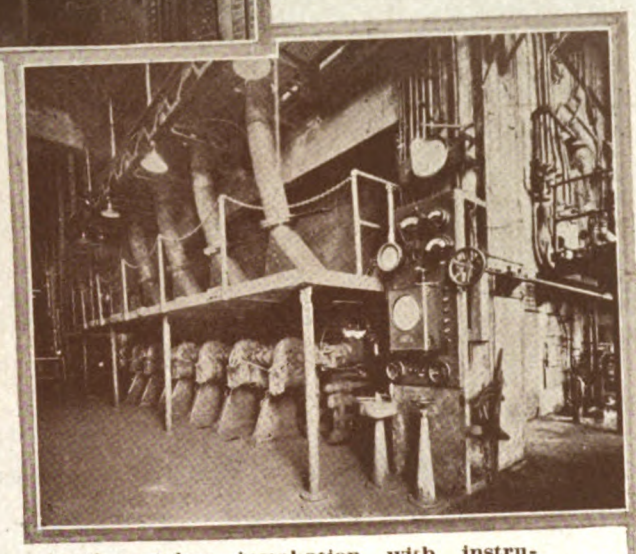
Bill smiles. "I expected to be called up here on that. Well, here's the story. You've been running them soap kettles night and day this past month and our records show that we have made five million pounds more steam this month than last. I don't want to bother you with all the figures I've got, but, when you figure it out, they show that we have knocked off a little better than 69 per cent. efficiency in the boiler house, which is even better than last month. But that is natural, because we had a little better run of coal."

"Guess you're right, Bill," says the superintendent, "but you better let me have those figures for the manager, when he comes down tomorrow.

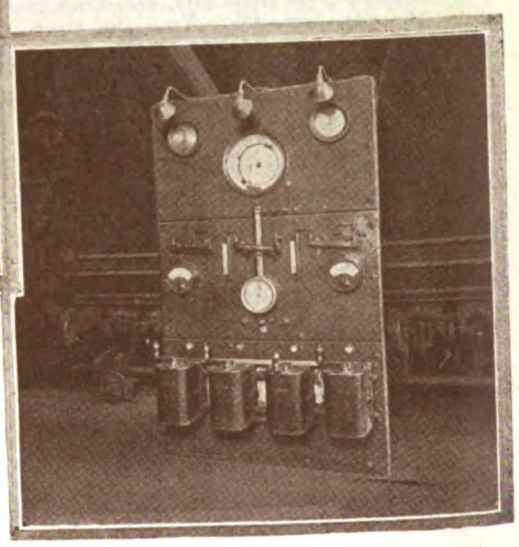
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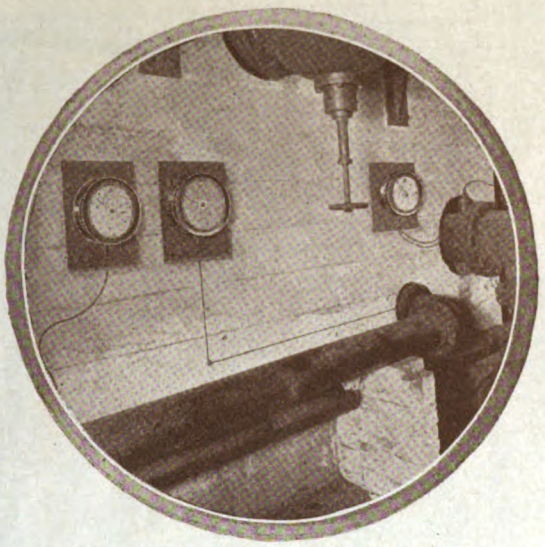
When flow meters and draft gages are mounted upon the boiler front in plain view from the firing floor, their usefulness is greatly increased, as compared with locating them in the engine room or at some distant spot. Stokers, as a general rule, are capable of greater average continuous efficiencies, particularly at considerable overloads, than hand-fired grates, due to better fuel distribution. Even in stoker installations, however, instruments are valuable in maintaining the operating economy which is possible with that equipment.



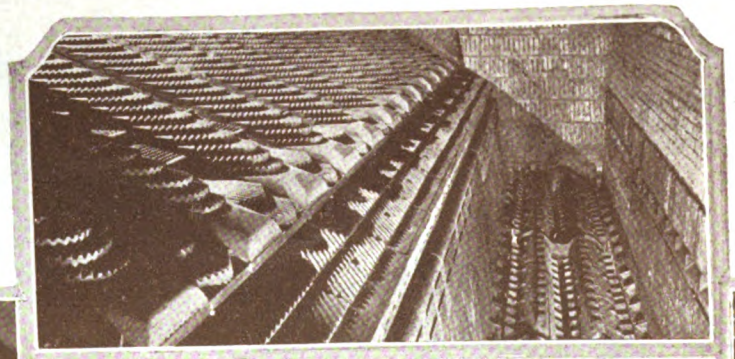
Another stoker installation with instruments and control conveniently located within easy view and access of the attendant. Convenience is a big factor in economical boiler house operation. You cannot expect a fireman to go too far out of his way to save coal, whereas he might stretch a point to hold steam.



Modern installations have recognized not only the value of complete instruments for guiding boiler room operatives, but have grouped them with their proper damper, blower and stoker controls so that the latter may be quickly and easily adjusted to meet variable load conditons.

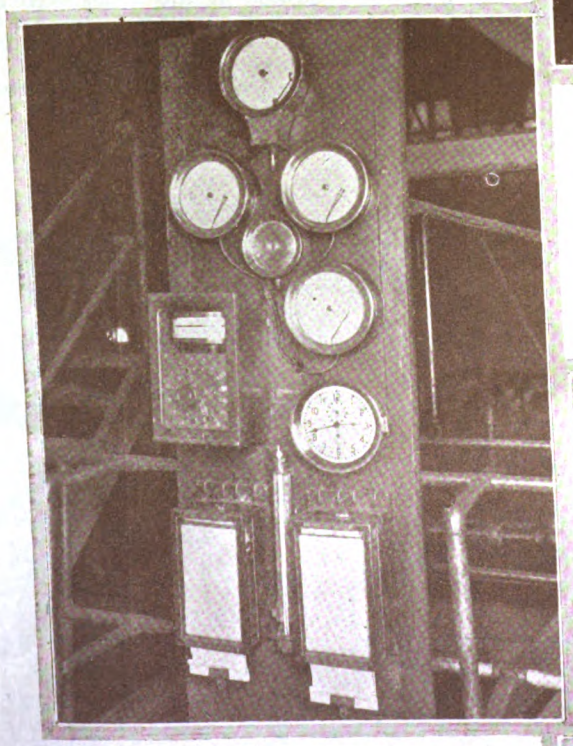


This picture shows how recording thermometers are connected to feed water lines providing a continuous record of fluctuation and losses of heat in the water entering the boilers. In this case it would seem at a glance that proper insulation would save many units of heat now going to waste by radiation.



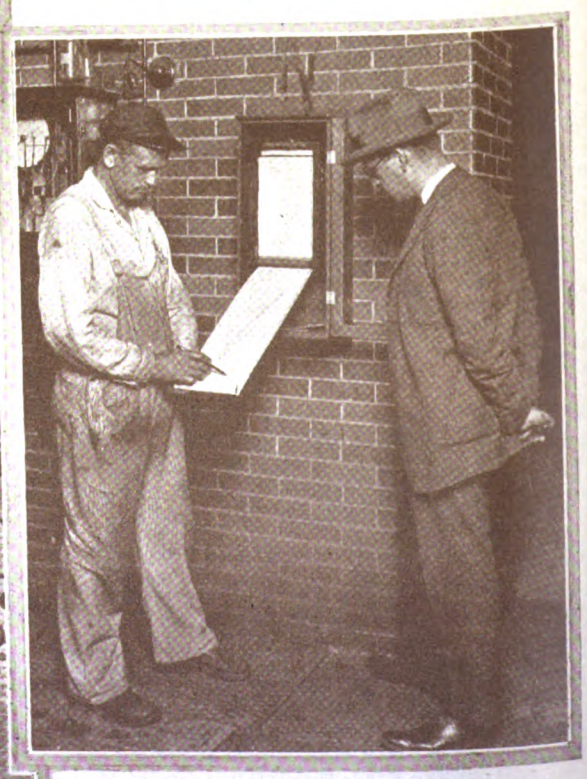
View of the interior of the furnace under a large water tube boiler, showing the retorts and tuyere plates of a multiple retort type of stoker. Replacing burned out tuyere plates is an item of expense in some plants that is due largely to unintelligent combustion control and lack of proper instruments

Below—A battery of thermometers and an electrical pyrometer ticking off the record in a corner of the boiler house. Note the automatic damper regulator for controlling the draft and the combustion rate in the furnaces.



In this battery of instruments we see an electrical flue gas pyrometer equipped with a multi-point switch which enables one instrument to serve a number of boilers, by throwing the switch to the proper contact.





Here we see the chief writing down the reason for the big jump in flue gas temperature when a couple of bricks dropped out of the front baffle in No. 1 boiler. That means a job for next Sunday to get things ship-shape.

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Where Do We Stand?

Julius H. Barnes Analyzes America's Industrial Development, and What It Portends for the Future

WITH all the various "blocs" and propagandists for this, that, and the other, each one vociferously promoting its pet ideas, it becomes increasingly difficult to separate news from propaganda; and well-nigh impossible for the average busy man to form an accurate idea of world events.

At the same time, if we are to plan ahead intelligently, we must first know something of the factors with which we have to contend. Is our industrial expansion at a peak, and due to recede, or is it in a state of healthy, continuous growth? Is the present chaos in Europe to continue indefinitely, or is normalcy in sight there, as here? Are we to forget, for years to come, the possibility of developing foreign markets for our products, or are conditions so adjusting themselves that our foreign trade will shortly be a calculable factor? These are some of the questions which the late war brought into being; questions the Versailles Treaty and subsequent political events have complicated, rather than solved. And it is with a view to answering these questions and in general giving a clearer perspective of this country's situation in relation to the rest of the world, that we present the following analysis—a composite of the written and spoken conclusions of the President of the United States Chamber of Commerce, Mr. Julius H. Barnes. These conclusions are based upon the well-reasoned analysis of a man particularly fitted for the task, and who has made the most of his exceptional opportunities for first-hand study of existing conditions both here and abroad.

* * * * *

TODAY, the most common standard of comparison is the "pre-war" year of 1913. It is true that the disorganization of war and of the

(Continued on page 64)



Julius H. Barnes, President of the United States Chamber of Commerce, who returned recently from Rome—where he headed the American Delegation at the meeting of the International Chamber of Commerce. Mr. Barnes combines a deep study of industrial and business conditions with an exceptional faculty for sane and logical analysis; making his conclusions, as presented in the accompanying text, of very real value to the men who direct American Industry.

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Handling Parts and Packages

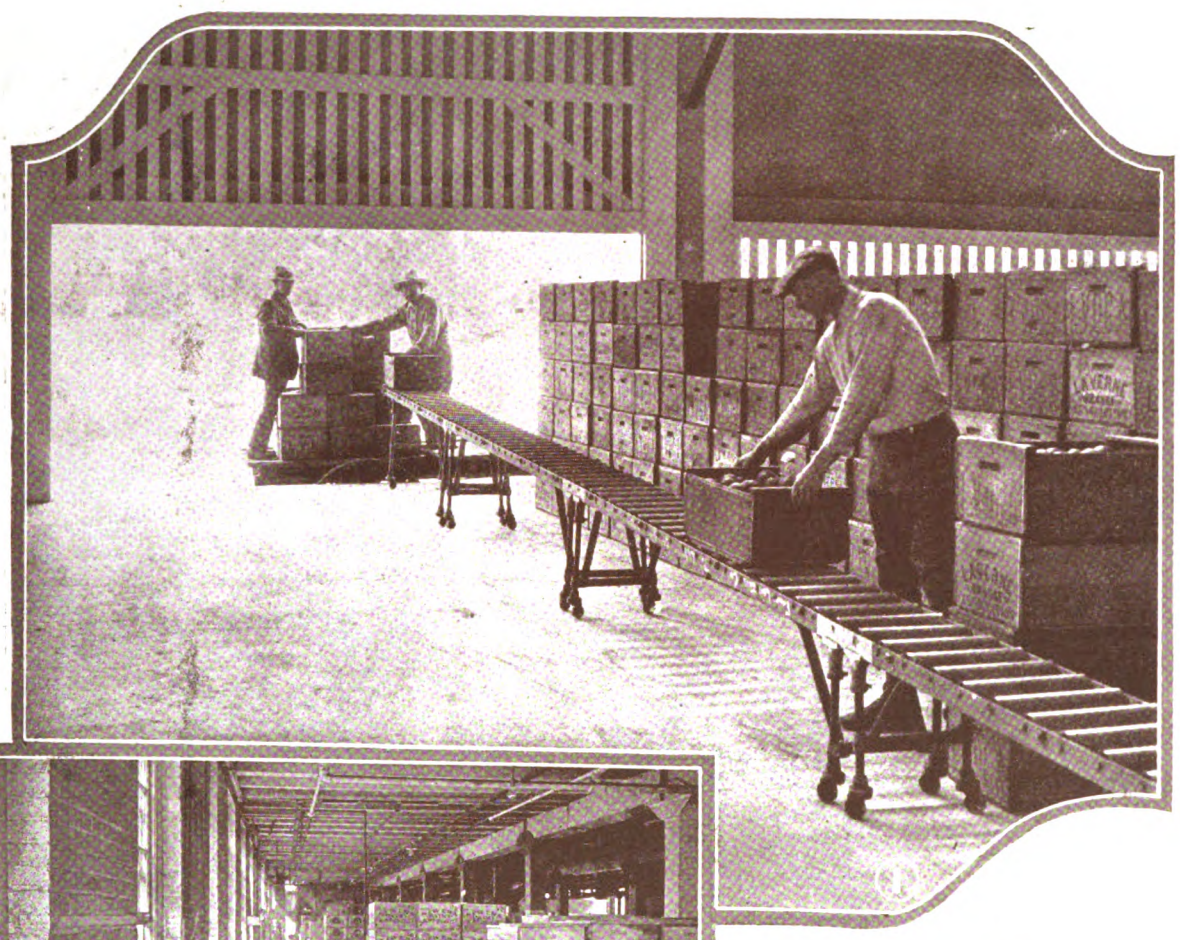
Equipment That Makes Production Run Like Clock Work

By Matthew W. Potts

THE handling of assorted commodities at first appears to be a very difficult problem, but there are many types of materials handling equipment that will handle anything from fragile glass to heavy castings. It is not necessary to pay so much attention to the type used, as it is necessary to pay attention to the construction of the equipment so that it will give a definite service.

To illustrate this point, we will consider the gravity conveyor shown in figure 15, which is of light construction. This conveyor would not be adaptable to the operation of handling heavy castings, as shown in figure 16, because the roller construction is too light, and the heavy castings would quickly damage the conveyor. Therefore, the first point in selecting equipment, is to see that it is properly built for the service required.

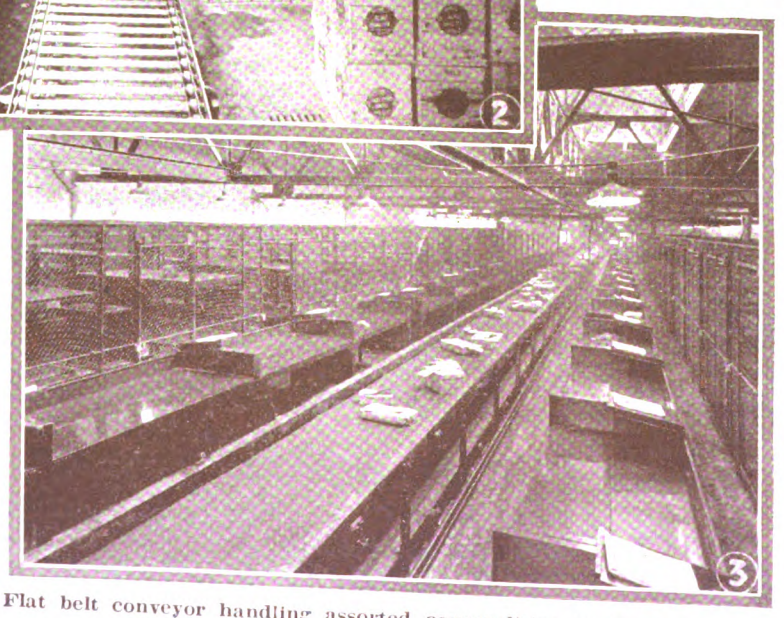
It has also been a theory among engineers, that when installing this class of equipment, one type should be used throughout. It will be noted by the illustrations that in practically every installation,





A straight run portable gravity conveyor reduces handling costs on many unloading operations.

The Push Bar elevator shown below carries packed boxes from the nailing machine to a gravity conveyor suspended from the ceiling, which carries them to the shipping department.

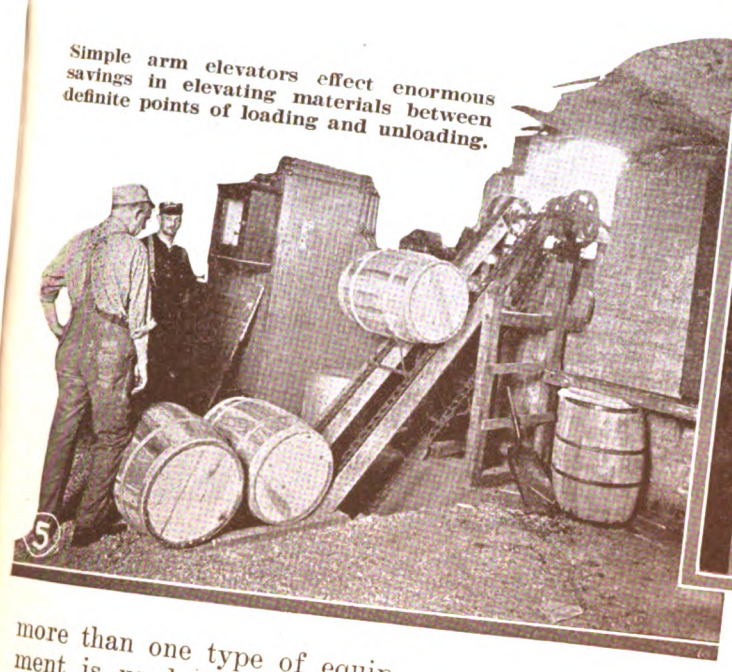


Co-ordination of various types of equipment is real materials handling.

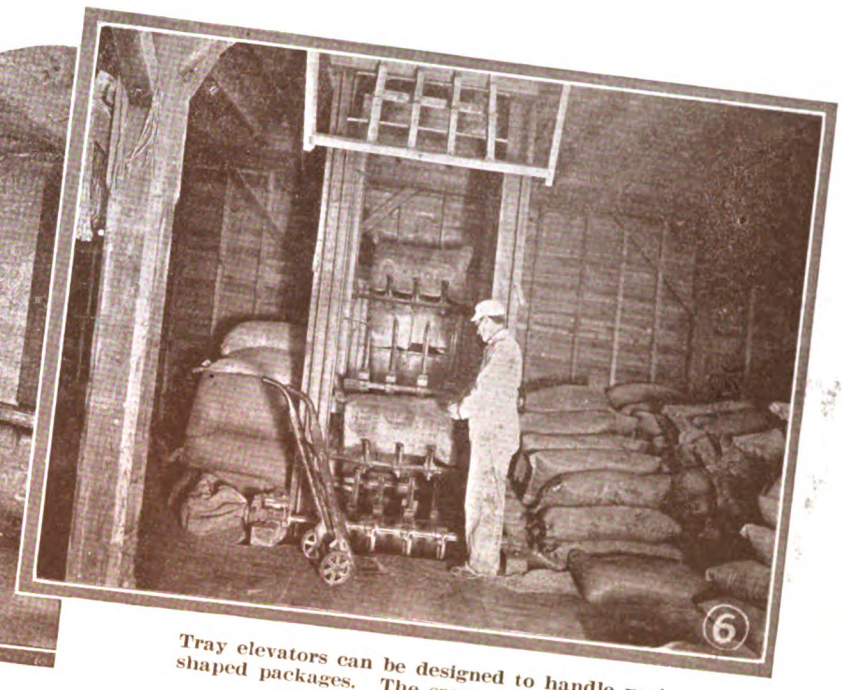
Flat belt conveyor handling assorted commodities in delivery room of a department store.



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Simple arm elevators effect enormous savings in elevating materials between definite points of loading and unloading.

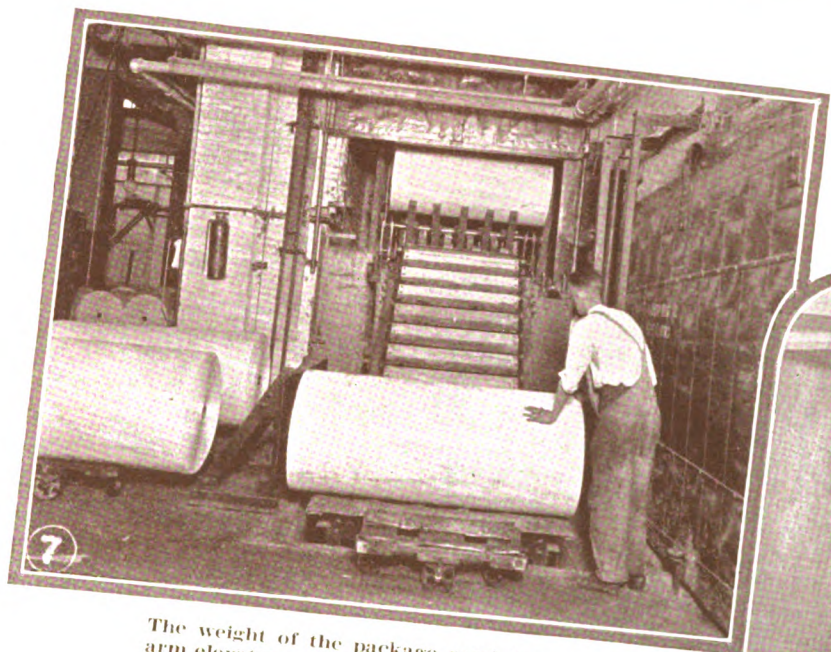


Tray elevators can be designed to handle various shaped packages. The same tray will frequently carry both barrels and sacks.

more than one type of equipment is used. For instance, figure 2 shows short sections of portable gravity conveyor, feeding to a slat conveyor, which carries the material the full length of the storeroom. At the end of the slat conveyor is a short section of gravity roller conveyor, which acts as a feeder to the push bar elevator which carries the material to the shipping room.

This installation shows good co-ordination of three types of materials handling equipment on one operation.

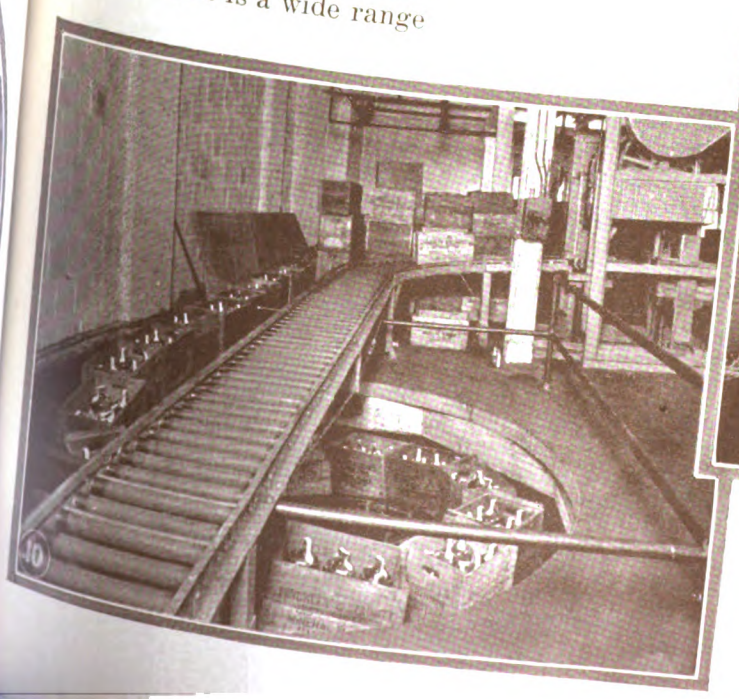
Each type of equipment shown can be used in various industries, and under different operating conditions. For instance, flat belt conveyors. Note how they are used for loading trucks, for handling bundles of loose clothes in laundries, conveying papers for handling packages in department store delivery room, as well as in the manufacture of chocolate bars, and tinware utensils. This is a wide range



Spiral chutes should be provided with fire doors at all floor openings. This photograph also illustrates the proper method of loading cases at intermediate floors.

The weight of the package carried by tray or arm elevators, determines the size of chain and detail of finger construction. The one here shown handles rolls of paper, having any length from 32" to 68", and weighing from 900 to 1,800 pounds. The slat conveyor feeder is of special design.

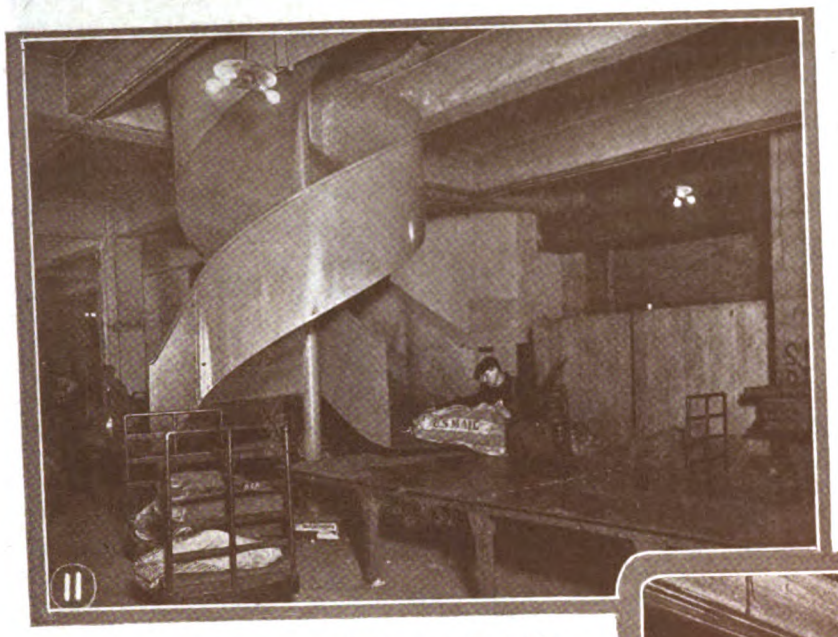




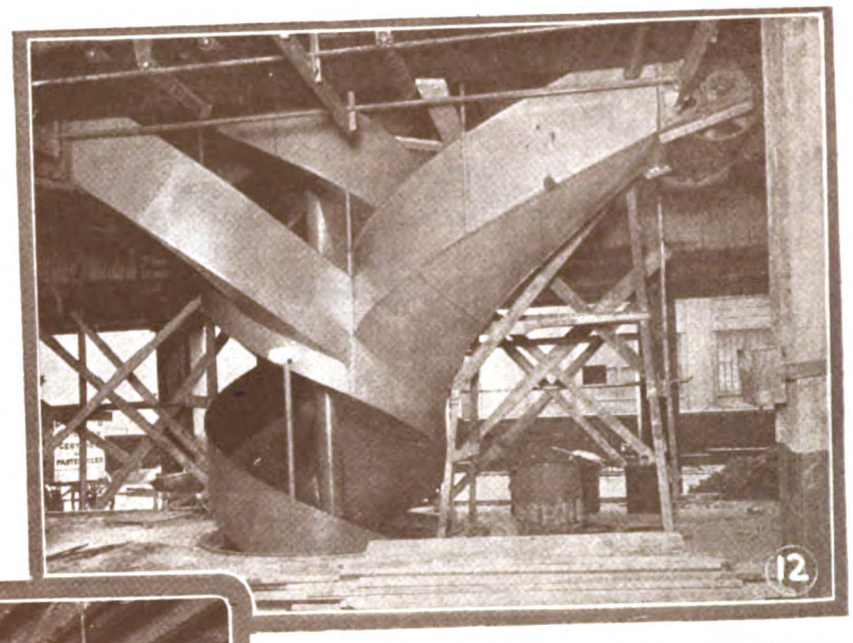
Bottling factories are extensive users of gravity roller conveyors, and gravity roller spiral chutes. The elevator is a slat conveyor fitted with push bars, carrying the load instead of sliding it on the metal surface.

Gravity roller spiral chutes require full circular openings in the floor, which are more difficult to equip with fire doors than common spiral chutes. To the right is a suspended tray elevator, which elevates the cases and feeds them to the gravity conveyor, which runs over the spiral chute.

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Double blade spiral chutes can be built around one post and pass through one floor opening. This shows the discharge of such a chute.



While spiral chutes are generally simple in design, the above double blade chute is more or less complicated, because of receiving materials direct from three belt conveyors.

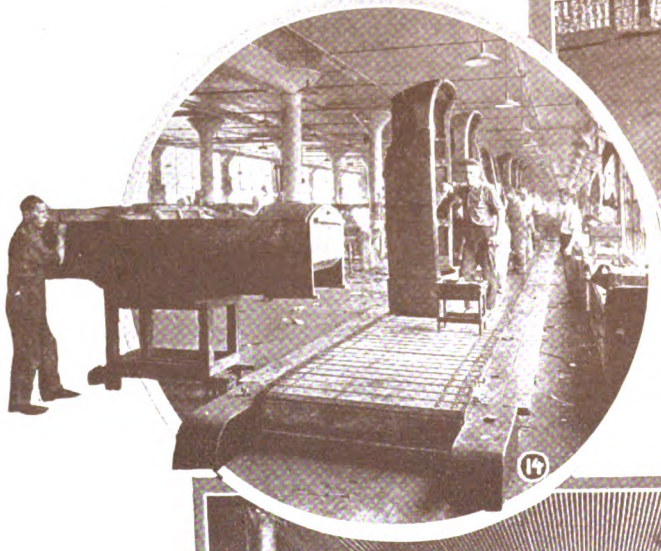


Apron conveyors greatly assist in progressive assembly work; some carry the materials while the man stands still, and works in a limited space, others carry both the materials and the men. This illustrates the method of loading and working on the conveyor.

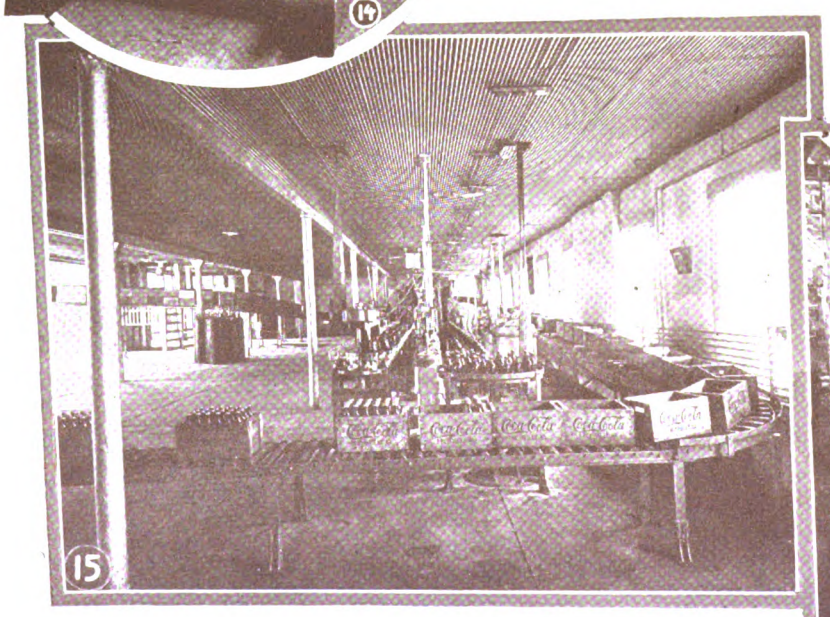
of adaptability for one type of equipment, but it is typical of what can be done with practically all types. Frequently the same operations which are shown being performed by flat belt conveyors, can, under modified working conditions, be done just as efficiently by slat conveyors or gravity roller conveyors.

The various types of equipment shown require power to operate them, except in the case of gravity roller conveyors, and gravity spiral chutes. These conveyors, which use the natural force of gravity, are by far the cheaper operating units.

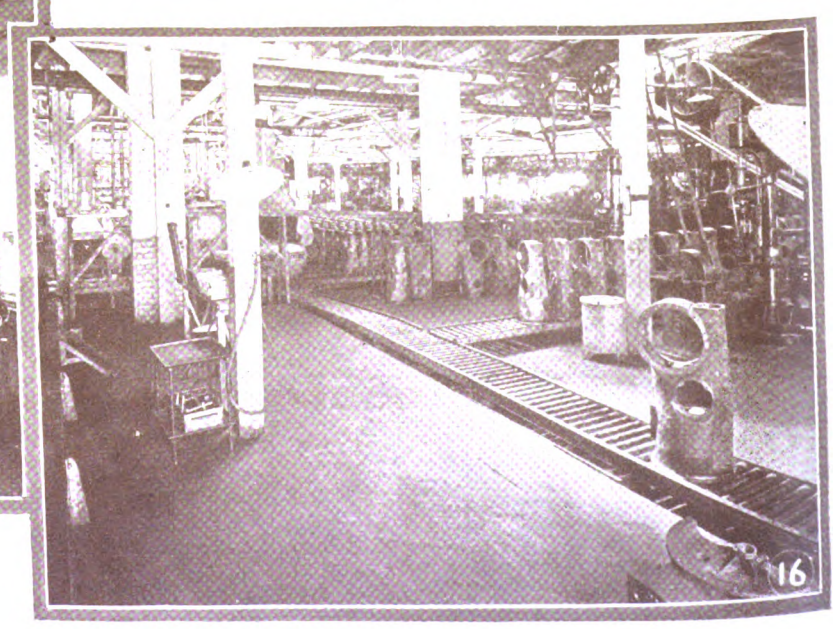
A typical installation is shown in figure 1, for unloading wagons and trucks. The section of conveyor being mounted on rollers or casters, permits it to be moved from



Many industrial plants have found it economical to install spiral chutes. The above shows how small packages hug the outer guide rail. This same chute can handle large cases say 24" by 14" by 30".



Bottling works are extensive users of gravity conveyors. This is an efficient method of bringing empty cases to the bottling machine and taking the filled cases to the shipping room.



Gravity conveyors also fit into many machine shop operations, co-ordinating and speeding up the work. Care should be taken to stipulate what the conveyor is to be used for, when purchasing.

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Arrangement of portable gravity roller conveyor with slat conveyor for unloading crates of sheet tin from freight car. A hand operated mechanism provides for the lowering of the crate from the end of the gravity roller conveyor to the slat conveyor.

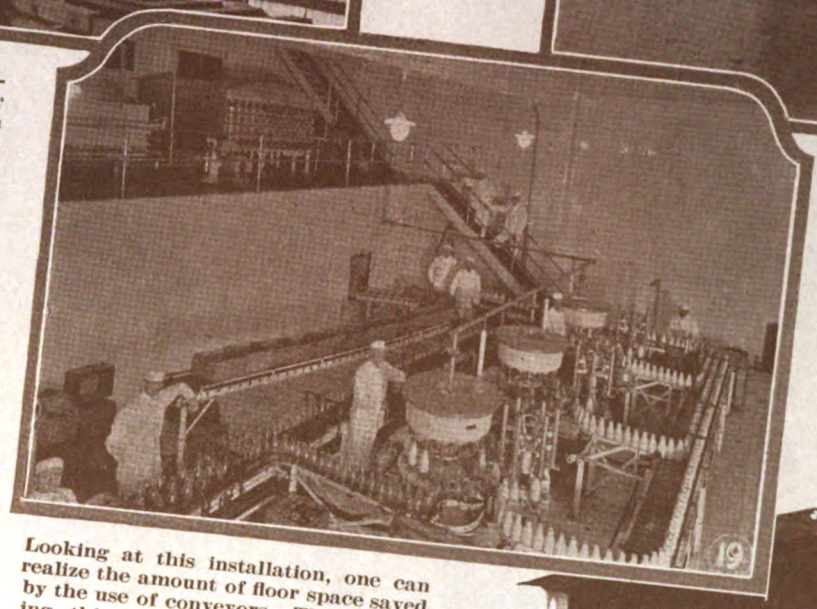


No one type of conveyor can perform all operations. This view shows a gravity roller conveyor, slat conveyor and special conveyor for the handling and washing of grapes.

one part of the building to another, without serious loss of time.

On long runs of gravity conveyor, where a fairly steep gradient is required, it is often necessary to provide boosters, or push bar elevators to raise the material sufficiently for it to continue to travel by gravity.

Where the operation is predetermined, and equipment definitely located, as in figure 15, the gravity conveyor is very advantageous, because it can be used for a storage rack, as well as a conveying medium. In this installation, the boxes are received at the far end of the room, filled with empty bottles. These bottles are removed and fed to the filling machines, and the empty boxes are placed on the gravity conveyor, which



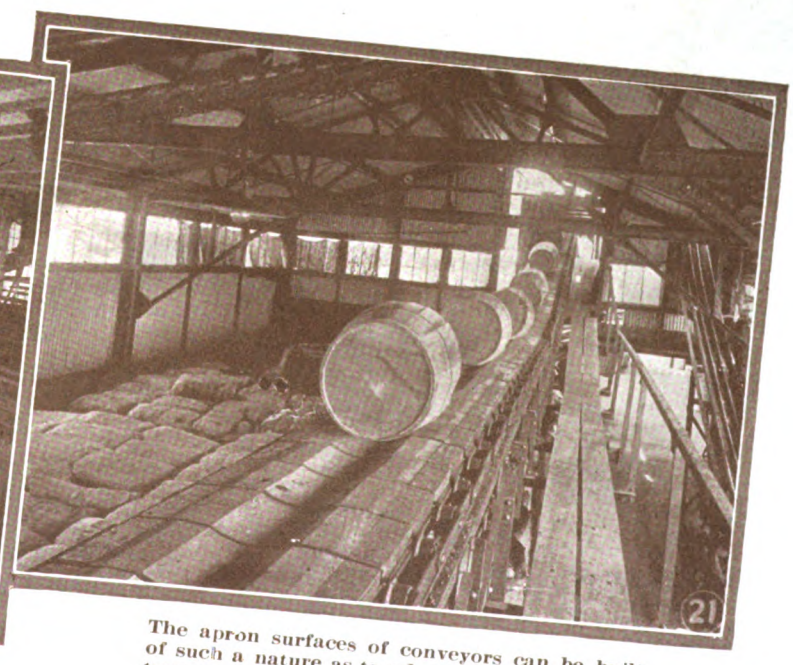
Looking at this installation, one can realize the amount of floor space saved by the use of conveyors. Think of doing this volume of work by hand methods!



Apron conveyor acting as an elevator, for rasing heavy buckets of paint from basement storage to railroad cars.



Textile plants stand accused of using child labor. Conveyors are now being found cheaper and more efficient.



The apron surfaces of conveyors can be built of such a nature as to adapt themselves to the type of package to be handled. The above is giving good service in transferring barrels of sugar from the refinery to warehouse.

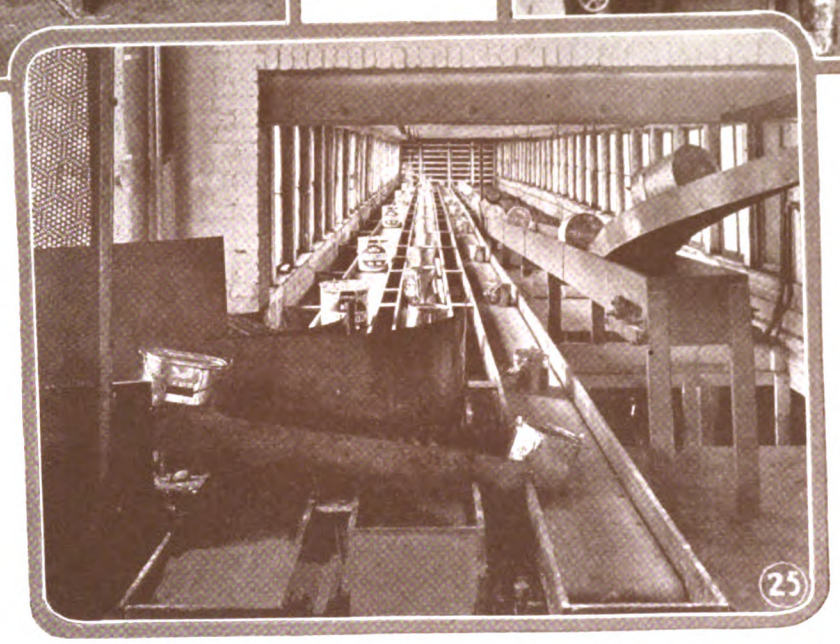
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Flat belts handle many different types of packages. This shows the method of discharging from one belt to another at right angles.

carries them to the point shown. As filled bottles are received from the filling machine, they are immediately put into the cases and moved forward to the storage room or shipping department, thus avoiding congestion. Where thousands of bottles are handled per day, as in this case, it would be difficult to obtain efficient operation with old hand truck methods.

Machine shops and automotive industries have found gravity conveyors of wonderful assistance in moving materials from one operation to another. Figure 16 shows heavy castings moving under their own power between various machine operations. The



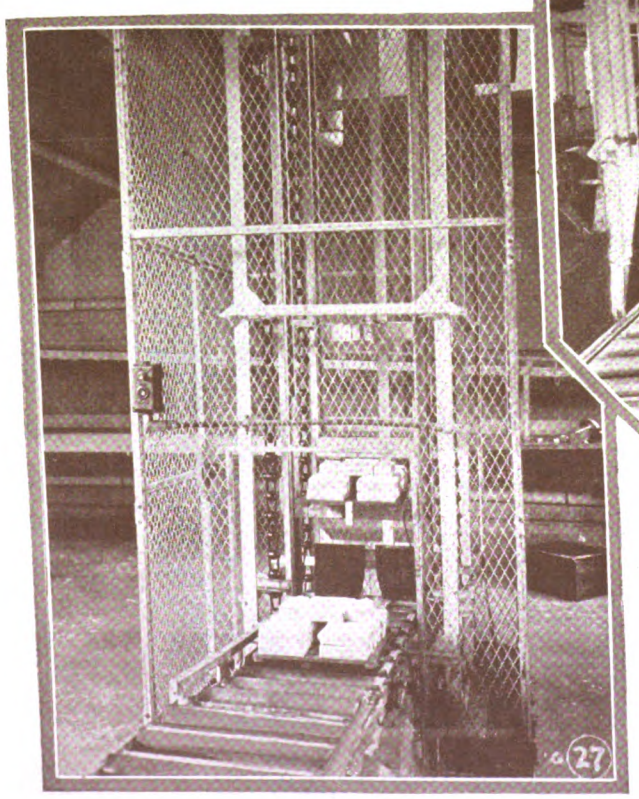
After tinware is inspected, it is placed on the belt which carries it to the shipping room; at right angles to the belt shown, and along the far wall, the other conveyors which discharge to flat belt conveyors carrying the finished product to the shipping room.



gradient in this operation is very slight, as the castings are so heavy that they move forward very easily.

When desiring to take a casting from the main run conveyor to the first run shown at right angles, it is necessary for a man to guide them at this point. When, however, they proceed directly to the second right angle run, they convey themselves without attention around the 90° curve. Such an installation invariably speeds up production, and eliminates idle productive equipment due to lack of material being on hand when required.

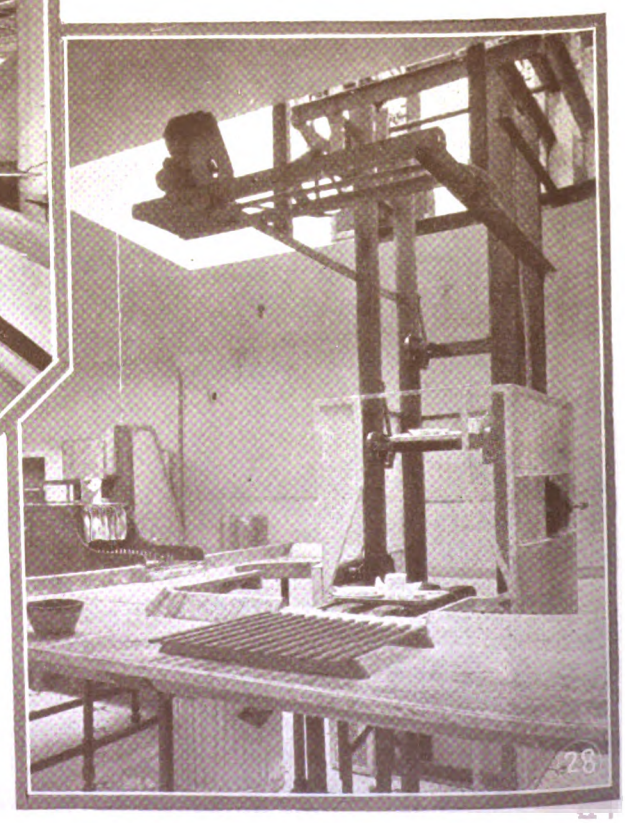
An ideal installation, in any type of plant, is compact, and the use of conveyors frequently saves thousands of square feet of floor space that would be required if hand methods



When elevators are installed in the center of a room, they should be fully protected by safety guards.



Large laundrys are eliminating hand truck methods, and coming to the more extensive use of conveyors.



Tray elevators are being installed in restaurants to carry trays of dishes from the main dining room to the washers. While this is not a productive operation, it is a matter of service.

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Flat belt conveyors fitted with cleats, can be used as elevators between floors. This one is used for carrying chocolate bars to wrapping machines.

were employed. Figure 19 shows the modern method of bottling milk: an installation that has three runs of slat conveyor, and one run of gravity conveyor. By mounting angle guides above the carrying surface of the slat conveyor, it is a simple matter automatically to feed the bottles to the filling machines, and by employing the same method on the outgoing slat conveyor it is easy to guide the filled bottles in the right direction. The short length of gravity conveyor immediately carries the empty cases away from the man who has removed the empty bottles, and feeds them directly to the man requiring them for loading the filled bottles before placing the completed case in the refrigerator. The use of materials handling equipment in this instance undoubtedly saved considerable floor space, and it is easy to realize the amount of confusion that would exist, handling this quantity of milk by hand.

Plant executives have given scant attention to the use of common spiral chutes for lowering materials, as they consider them adaptable only to warehouses. These spiral chutes take up very little room, and are more efficient for lowering materials than the usual freight elevator. Figure 13 shows a closed center spiral chute, handling small cans of paint. This same chute can also handle a fairly large size box. In fact, it can handle a

(*Continued on page 49*)

It is not only the function of equipment to convey and elevate materials but it can also be used for lowering materials, and below is a special machine for lowering milk cans to trucks.





Even if the commodity to be handled is extremely fragile, breakage will be less when conveyors are used than when hand methods are employed.



Installations do not necessarily have to be expensive. Simple equipment shown for loading trucks, saves enormous sums per year.

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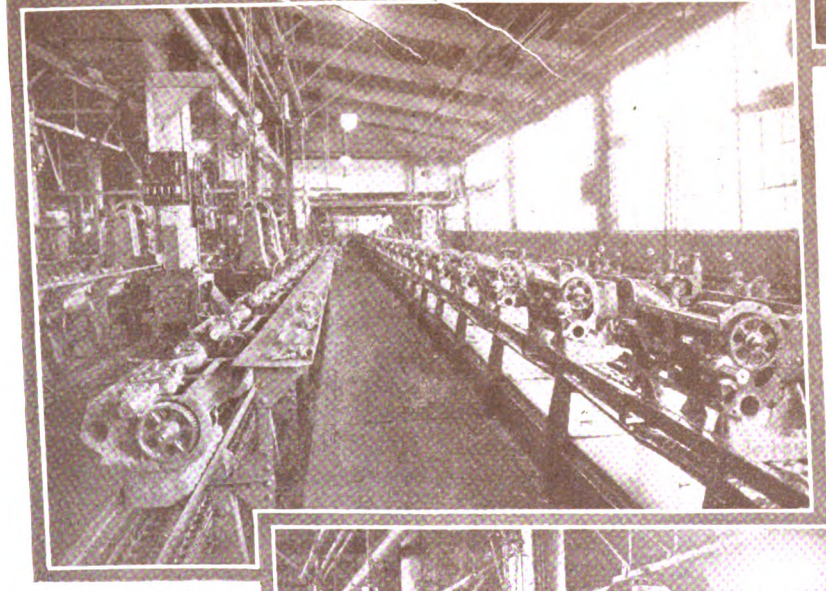
Assembling Fordson Tractors "On the Move"

More than Forty Tractors are Born Here Every Hour

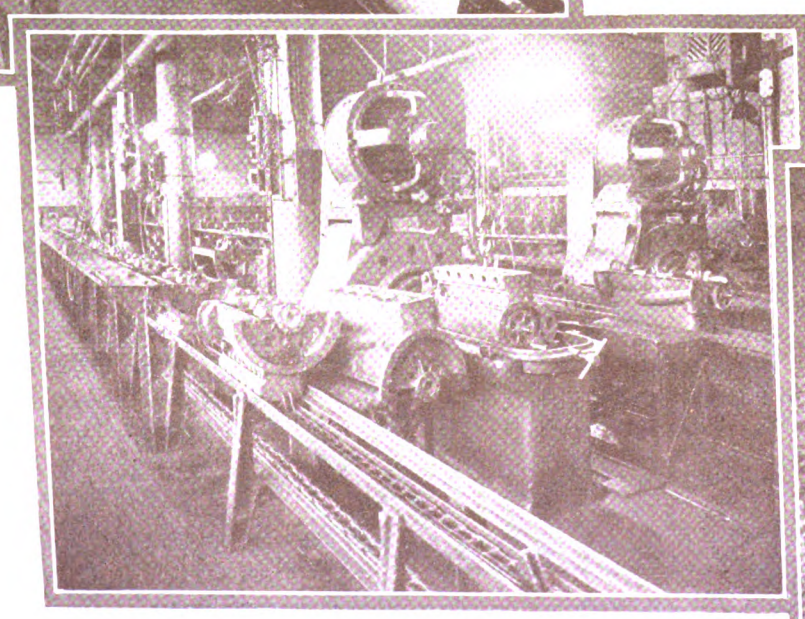
BY JOHN H. VAN DEVENTER



This is the beginning of the assembly of Fordson tractor motors. Note the chains for actuating the moving "lines."

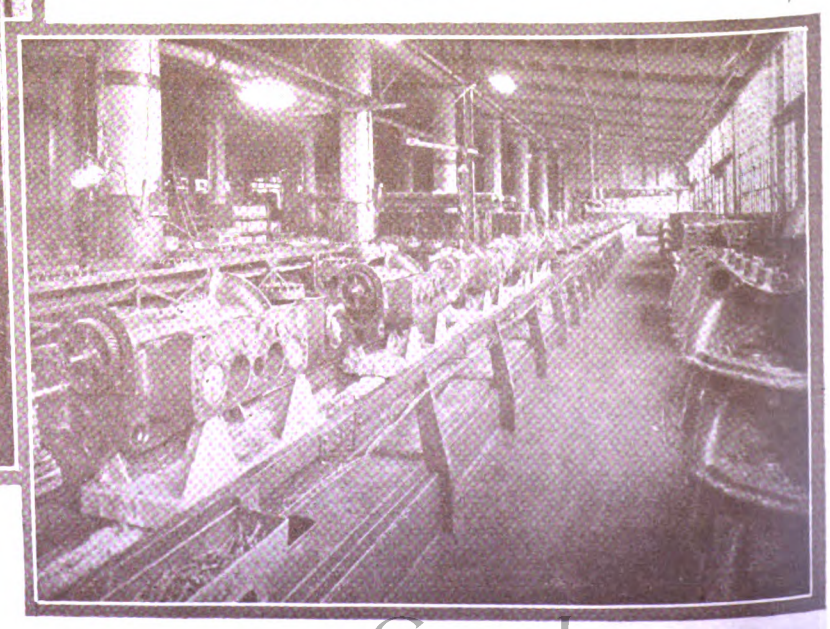


After the crank and camshaft assembly is completed, the motors are placed on the line at the right for further assembly.



Two of the burning-in machines where the crankshaft bearings are glazed to running finish.

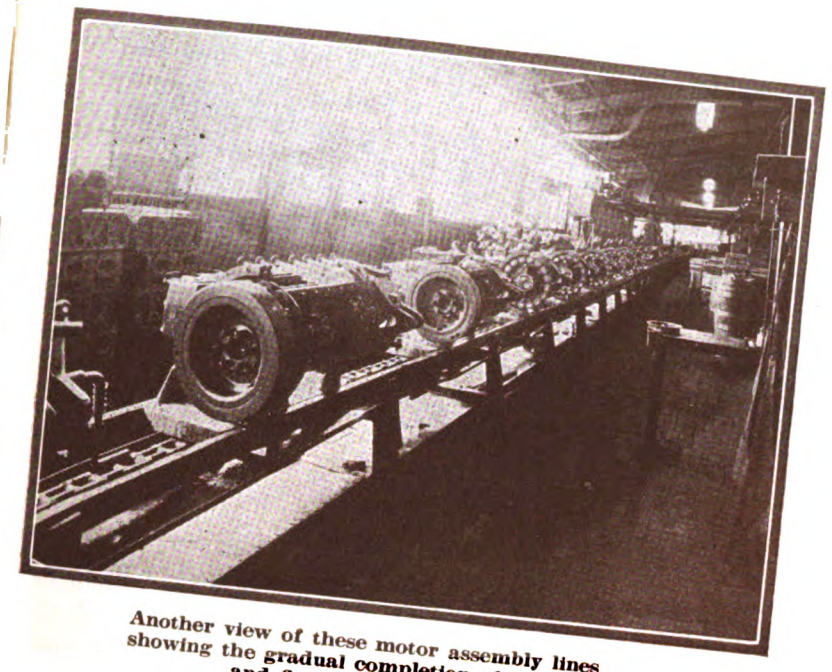
Below—Here the pistons, rods, tappets, springs, magnetos, etc., are added, the motors being completed at the end of this line.



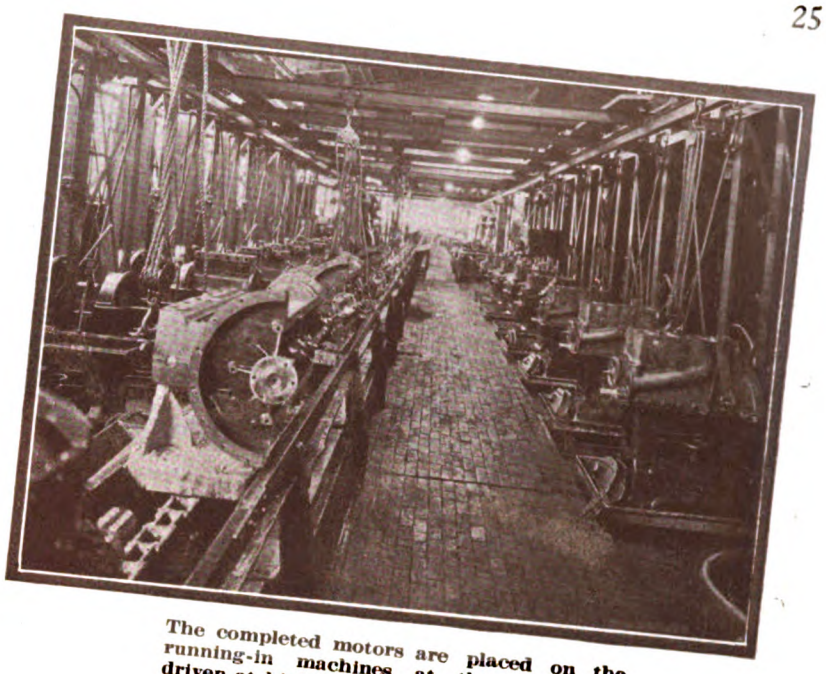
IT has been said that Henry Ford originated his moving assembly lines from an idea obtained by him after seeing the overhead carriers at work in the packing plants. For the meat-packing industry was the pioneer in adapting mechanical transportation in production, and particularly overhead trolley carriers to making the flow of work continuous throughout their plants. Whether this was the source of Ford's inspiration is perhaps immaterial, but it is interesting to reflect that the assembling of Ford cars and Fordson tractors on moving "lines" reminds one strongly of the process by which our pigs, sheep and cows are "disassembled" into lamb chops, pork chops and beef steaks. And while the one process consists in putting together and the other in taking apart, both of them through the systems of mechanical transportation employed, have been developed to remarkably high degrees of efficiency—from the production standpoint.

I have spoken in previous articles about the principles of "integrated manufacture" of which Ford's River Rouge

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Another view of these motor assembly lines showing the gradual completion of magneto and fly wheel assembly.

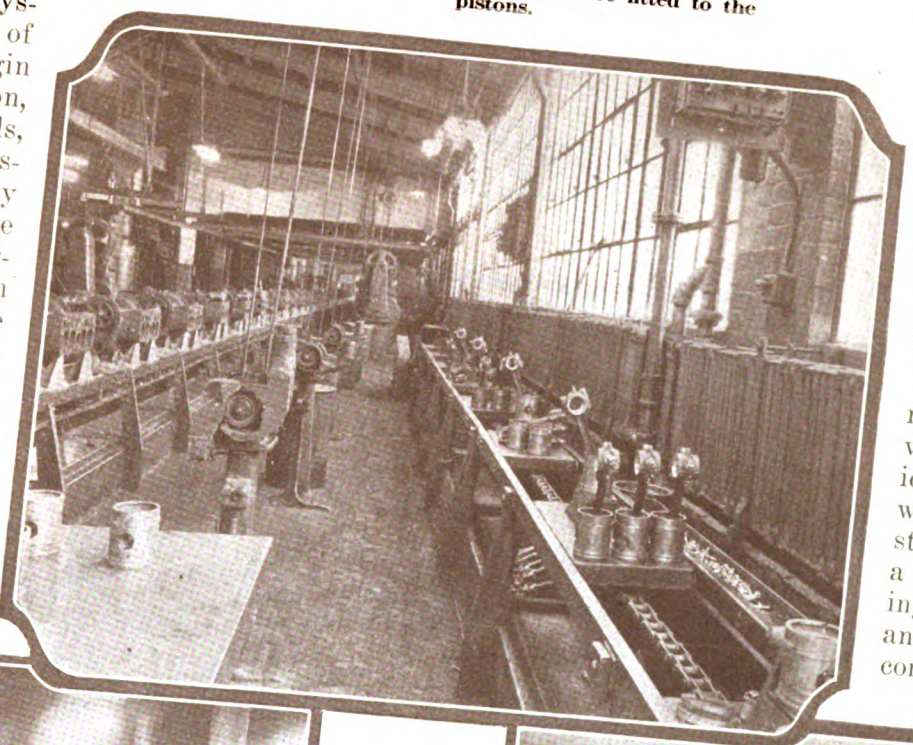


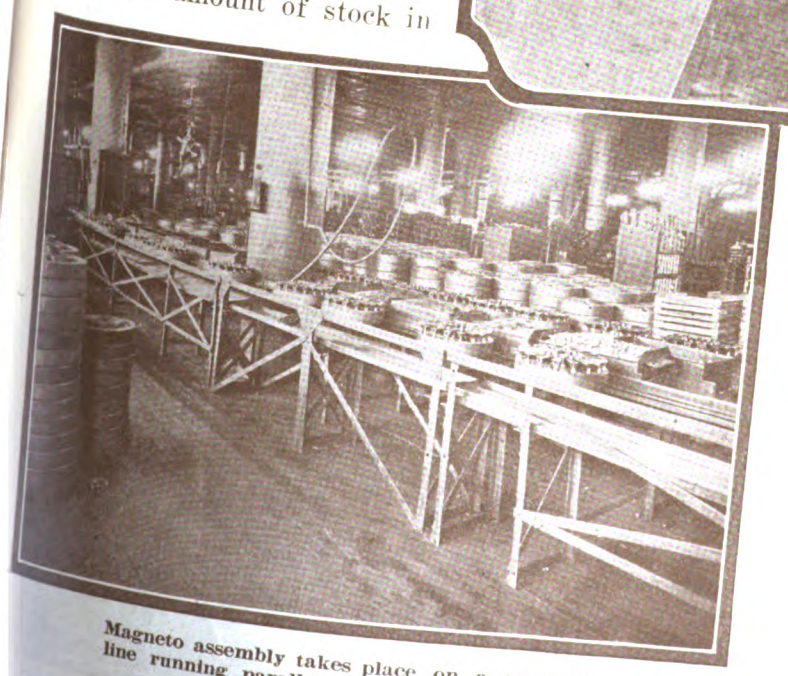
The completed motors are placed on the running-in machines at the right and driven at high speed to test the correctness of assembly.

plant is such a splendid example, and which is based upon arranging the work in continuous and regularly flowing streams which come together at the right place and time, and which finally result in a completed product delivered at a nearly constant rate. A system of this sort requires of course a huge output to begin with. It requires in addition, a huge outlay in materials, handling equipment, and possibly an even greater outlay for the brains to plan it. Once secured, however, it is a miracle worker with respect both to *production* and *cost*, because it eliminates not only "soldiering" but the even more prevalent time wastes which are incurred through workers not being supplied with the right materials at the correct time. And not only this, but a system of this sort reduces to a very minimum the amount of stock in process. At the River Rouge plant, where the integrated system is applied from the ore and coal piles clear through to the finished tractor, less than thirty days stock requirements are necessary to balance production schedules. Contrast this with the usual practice which involves tying up the interest of money invested in stock and materials for from ninety days to six months, and you will see what a tremendous saving is possible on such huge production quotas as are involved in the Ford industries.

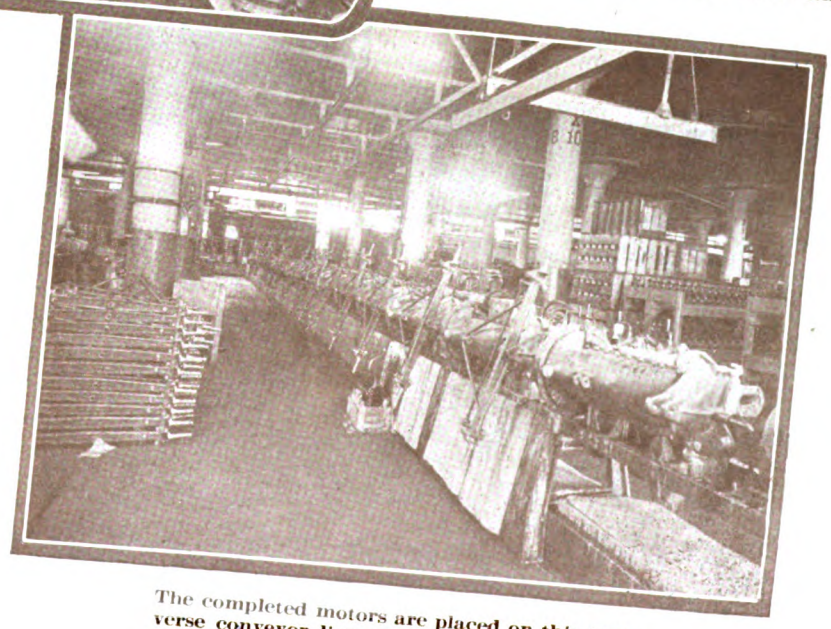
At no other point in the manufacturing cycle can one visualize these savings as vividly as in assembly. It is here we have a spectacular demonstration of the rapid growth of a complicated machine starting with a few simple parts and ending with the familiar completed mechanism. It is an

Below is a minor assembly line also power driven on which piston rods and rings are fitted to the pistons.



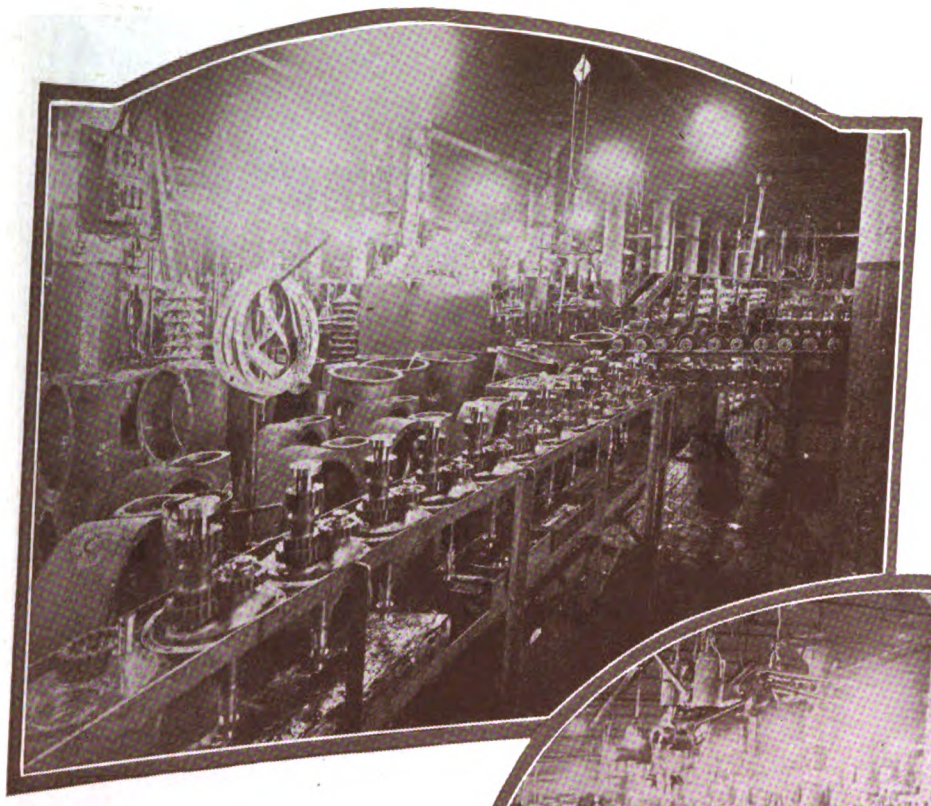


Magneto assembly takes place on a separate line running parallel to the motor assembly lines.

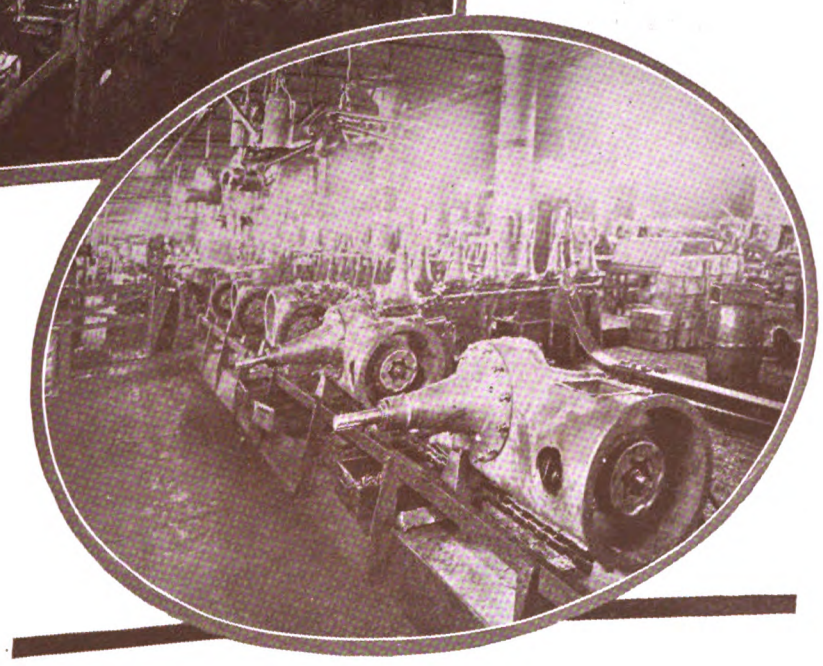


The completed motors are placed on this transverse conveyor line which carries them to the final assembly line. Meanwhile the front axles are attached.

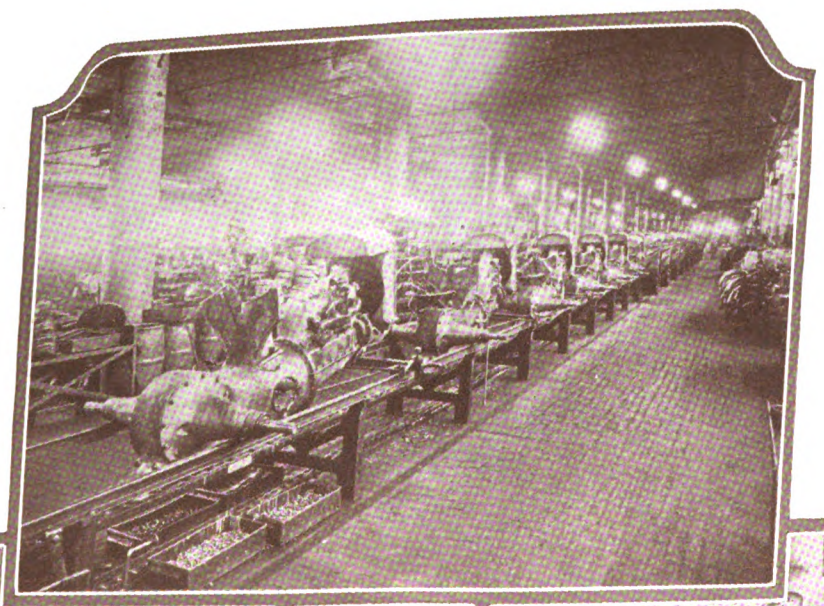
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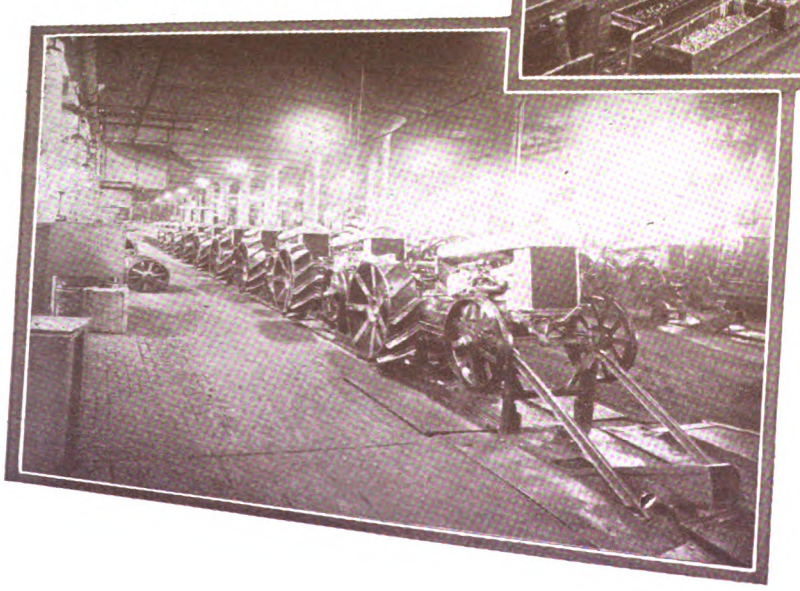
The progressive assembly of speed change gears for the transmission is shown in the picture to the left



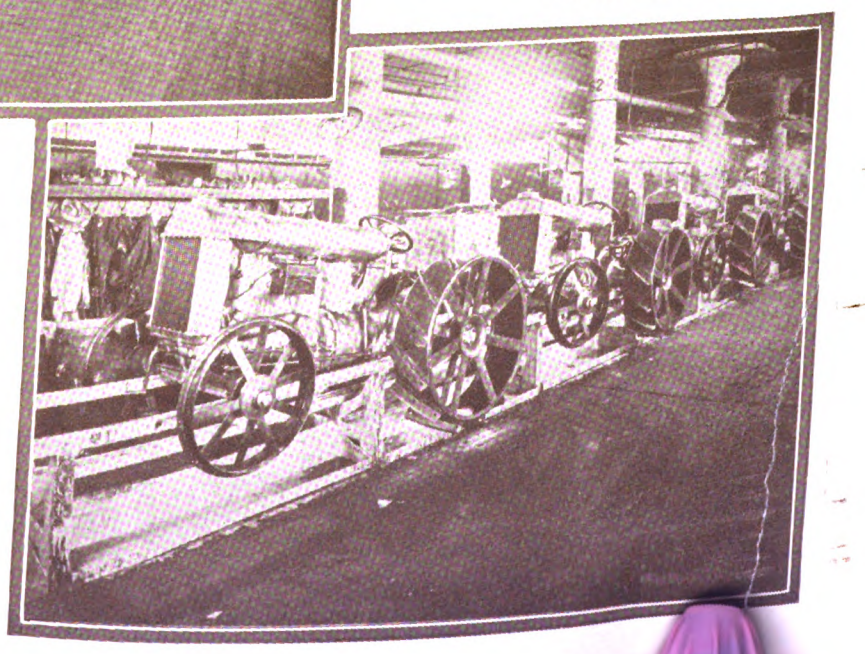
At the right are the transmission housings and rear axle assembly. Overhead may be seen special lifting devices for picking up the product.



At the right is a view of the final assembly line. Here the first step is to connect the motors with the transmission frames shown above.



On this final assembly line the tractor grows step by step until in the foreground it is ready to come off and run under its own power.



This is a view of the paint line where the red and gray finish characteristic of the Fordson is given "on the move."

object lesson in the power of mechanical coordination.

It takes an average of two hours and thirty-nine minutes for the complete assembling of a Fordson tractor from the time that the cylinder is placed upon the cylinder assembling line shown in our first picture to the time that the completed machine, fully painted and ready to run under its own power descends from the rails of the paint line shown in the last picture accompanying this article.

A number of parallel assembly lines extend North and South as shown in the first illustration. Here the motors are assembled and run in. Across the aisle and parallel to these lines are others on which the magnetos are assembled, the transmissions put together, and the rear axles and transmission housings completed. The direction of flow of these lines is from South to North. Here they meet a transverse line shown in the last picture on page 25, on which the front axles are attached to the completed motors. The final assembly lines run from North to South and start with the union of motor and transmission housing which gradually grows through the addition of radiator, fuel tank, steering gear, wheels, etc., into the recognizable finished product. The rates of movement of the various lines and the number of men working at them are adjusted in conformity with the demands

(*Continued on page 56*)

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(2) With three 100 Watt type "C" lamps and dirty glass meter registered 2½ ft. Candle illumination.

(3) After cleaning with Skybryte all electric lights were turned off and light meter indicated 15 ft. candle illumination—an increase of 600 %

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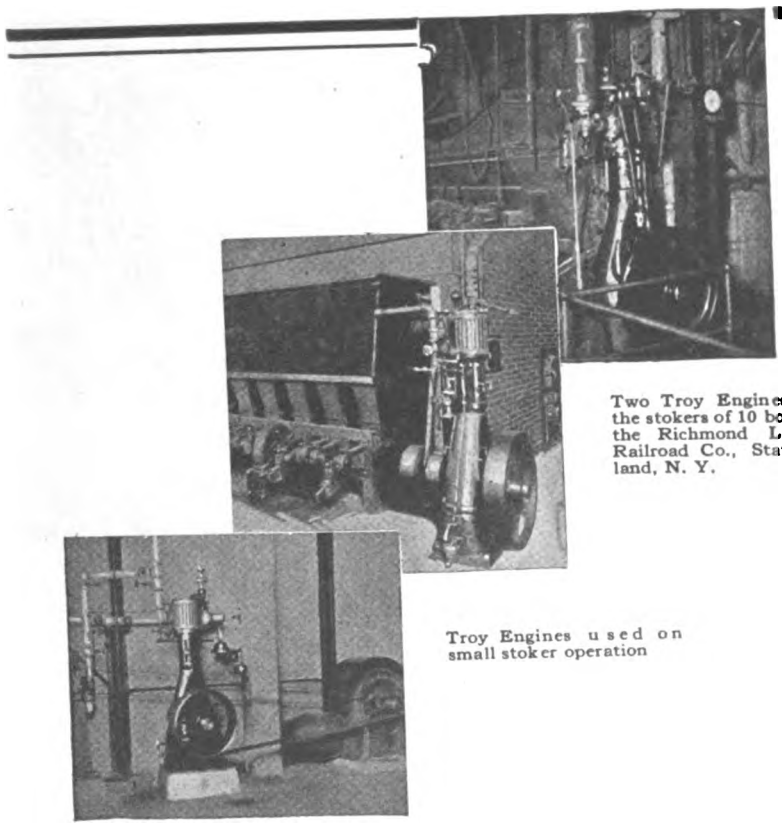
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The Why and How of Pre-Heating Fuel Oil

(*Continued from page 13*)

oil heater. In many cases it will be necessary to combine both these methods of heating.

While the natural characteristics of a fuel oil will govern the degree to which it should be pre-heated, to a great extent, yet the climatic conditions should always be taken into consideration. For example, a twelve degree Baumé gravity oil fired in the West Indies, where average atmospheric conditions might approximate 90 deg. F., would not require the same amount of steam for heating or as perfected a heating system as a similar oil fired in Northern Canada in the winter time, where the atmospheric temperature might continue at or below zero degrees for most of the time. Therefore, the problem of determining how and to what extent a fuel oil should be heated will in general be solved best by actual experiment and experience.

With the increasing necessity of resorting to the usage of heavier crude oils which may or may not have been topped of their lighter components, such as are obtained from the Mexican and Californian fields, the question of the potential danger involved in their heating is worthy of discussion. In order to reduce the viscosity of such fuel oils sufficiently it will in general be necessary to pre-heat them considerably above 200 deg. F. and, as has been already stated, oftentimes above their flash point. Due to the fact, however, that usually these grades of oil will have decidedly varying flash points, and since at best their content of lighter, highly volatile products will be relatively low, the amount of the oil tending to flash at temperatures in the neighborhood of 200 deg. F. will be comparatively slight. Since the flash will only be prevalent in proportion to the rate that these more volatile constituents are freed from the surface of the oil, and there will be little or no possibility of the entire volume of the oil flashing simultaneously, the hazzard will be practically negligible. Oftentimes such crude oils will flash at temperatures below 100 deg. F. when they are pumped from the wells. On weathering, however, in open storage tanks, or in the course of pumping and handling to tank cars or ships, the greater percentage of their more volatile hydrocarbon contents will vaporize and pass off into the air, either freely, or via vent pipes. As this occurs, it is evident that the tendency of the remaining oil to flash will decrease, and its flash point will be proportionally raised until it may be in the neighborhood of 150 to 175 deg. F. when the oil finally reaches the consumer.

There are a number of varying designs of fuel oil heaters on the market today, of more or less simplicity of construction according to the builders' ideas, etc. In effect, however, they all embody the same principle and strive toward the same end, *i. e.* to lead either live or exhaust steam around or through an arrangement of piping which is enclosed in a receiver or a similar pipe coil of greater diameter. The transmission of heat thus occurs by convection to, and conduction through the metal of the inner coil, either outward or inward, from the steam to the oil, the latter being heated accordingly. In general, fuel oil heaters can be grouped under the following classifications, although it can be appreciated that variations may be met with which at first sight might appear to fall in a class by themselves. The most prevalent types of fuel oil heaters are, therefore:

1. The Endless Coil.
2. The Double Pipe Coil.
3. The Film Type of Fuel Oil Heater
4. The Multi-pass Straight Tube Type.
5. The Return Tubular (straight) Pipe Coil.

The Endless Coil.—This type of heater is usually composed of a cast iron receiver of varying size, containing one or more so-called endless coils of either copper, brass or iron tubing or pipe. For a high sulphur oil the iron coil is the more durable. Either live or exhaust steam as desired, con-

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trolled by a manifold, can be passed through this coil, the oil to be heated filling the body of the receiver and surrounding the coil or vice versa. The joints in such a heater are preferably best on the outside, and in one head only. Thus the removal of the coil or coils is facilitated for inspection, repair or cleaning. Such heaters are marketed in varying capacities, depending upon the number of coils to be installed. These coils are, however, generally of one standard size according to the make of heater. The rate of heat transfer in such a fuel oil heater is relatively high due to the large amount of heating surface which is exposed to the oil.

The Double Pipe Coil.—Perhaps the most practically effective type of oil heater within the reach of the smaller operator is the straight, double pipe coil, consisting usually of 2-inch (oil pipe) within 3-inch malleable iron (steam) pipe. In this heater practically perfect counter-flow of the mediums is obtained. All the joints are on the outside, and therefore cleaning and repair are materially facilitated. The end fittings are of the standard ammonia type. It is frequently customary in such an apparatus to install removable, spiral retarders within the oil pipe, it being the opinion that these tend to give the particles of oil uniform circulation and more intimate contact with the walls of the pipe, thereby effecting better heat transfer over the same heating surface than if the oil were simply pumped through straight pipe. In the erection of such a heater it is well to allow a slope of perhaps one-half an inch to the lowest pass in order to enable any condensed steam to flow out by gravity. This practice will insure against stagnation of water in the coils, and if the pipes are not sprung apart too far there will normally be no danger of leakage at the lowest return bend fitting. To determine the oil temperature at outlet the oil pipe should be drilled and tapped for a thermometer well or a special hot water thermometer, just beyond the outlet fitting. It is best practice to cover the 3-inch steam pipes of such a heater with a non-conducting covering to prevent loss of heat from the steam by radiation as much as possible. This heater can be built at a nominal expense in any fuel oil burning plant using standard pipe and ammonia fittings, and with average plant labor.

The Film Type of Fuel Oil Heater.—The principle of film heating has been adapted to a number of types of fuel oil heaters on the market, such as the multi-pass film heater, the corrugated film type, and others. In general such heaters are very efficient in their operation, and the rate of heat transfer is relatively high per unit of heating surface involved. The multi-pass film type of heater is built of close grained cast iron in the shell, being tested to sixty pounds working pressure. The heating element consists of steel tubes screwed into the cast iron head at one end, being free at the other for expansion and contraction. The oil tubes are tested to 150 pounds pressure. The velocity of the oil through these tubes is relatively high, the



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oil passing from one section of the head to the other via a multi-pass construction as shown in Fig. 4 and by reason of the rate of heat transfer suitable heating of the oil at all times is assured. It can be noted that steam is in contact with the outside of the tubes, and short circuiting in the shell is impossible due to the installation of a steam baffle. As a result the steam sweeps the entire length of the heating surface with the maximum opportunity for giving up its heat. For this purpose either live or exhaust steam can be used, according to the degree of heat desired.

Another form of film type heater is shown in Fig. 5. In this device the oil follows a spiral path suitably controlled by baffles, around an inner shell contained in the main receiver. This heater is built of pressed steel and can be readily and rapidly cleaned as the Figures indicate. The feature of this heater is that there are no copper coils to be attacked by sulphur in the fuel oil. As well, the pressed steel construction affords maximum strength than in any other type. This with minimum weight. Steam enters the body of the heater as shown, being in contact with the inner surface of the heating shell.

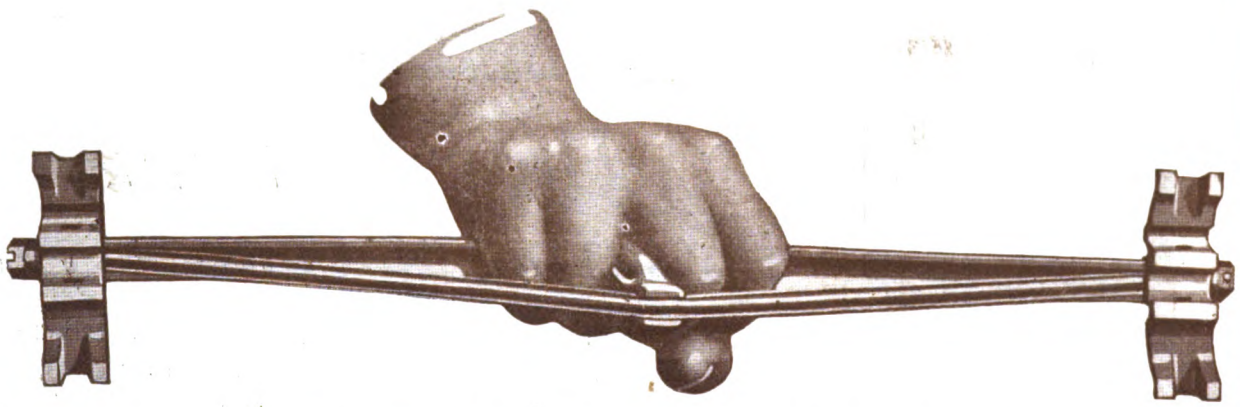
The Multi-Pass Straight Tube Type.—The application of the multi-pass principle to the straight tube heater has brought about the development of another type of fuel oil heater that is considered to be among the foremost in regard to heat transfer and steam economy, and various claims are made concerning its efficiency. Essentially it may be regarded as embodying the same principle as the return tubular straight pipe coil, with the exception that it is possible to use smaller pipe or tubing for the coil, and the result that the rate of heat transfer will be much improved. In addition, according to the number of passes and tubes per pass, the medium within the tubes will be divided into a number of individual and parallel lots, instead of all passing in series through the same run of pipe as is true of the return tubular coil discussed hereafter.

As usually designed such heaters are built with detachable heads which are cast with subdivisions to conform to the arrangement of the tubes. These latter may extend from end to end somewhat on the order of a condenser, or they may be built to return to the one tube sheet. The latter construction enables a heater of one head to be built, and it is more readily taken down for cleaning, inspection or repair. Up to six passes is the usual construction in heaters of this type, and it is customary to pump the oil through the tubes, the steam surrounding them and serving as the heating medium.

The Return Tubular Straight Pipe Coil.—For the engineer who must manufacture his own heating coil with nothing but standard pipe and fittings available, the most practical type of coil is the above as shown in the illustration herewith. The size of receiver, pipe and fittings will depend largely upon the fuel consumption of the plant, and the extent to which the oil is to be heated. For a smaller plant having in the neighborhood of

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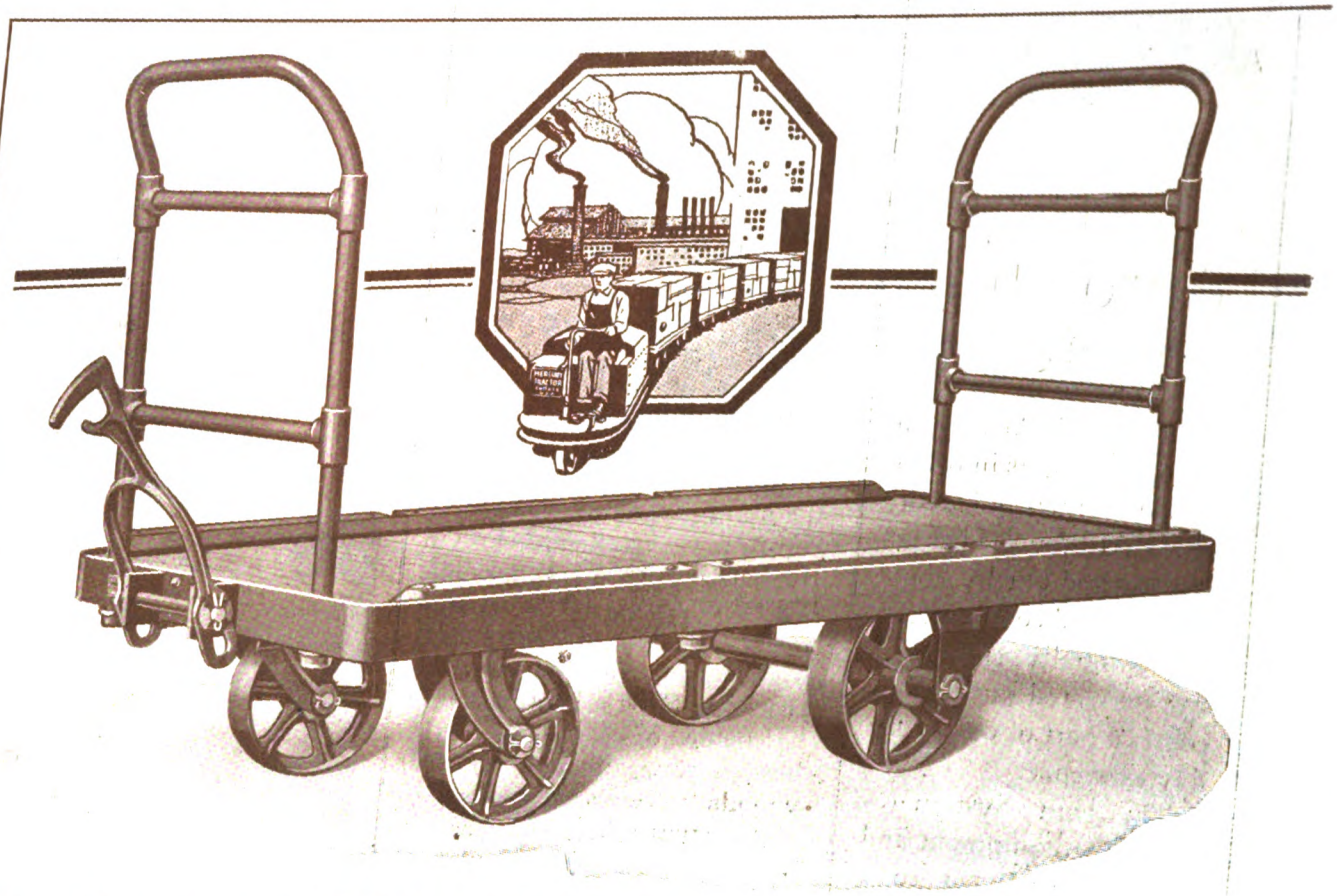
400 to 600 rated boiler horse power capacity, a heater composed of a receiver 18 inches in diameter by ten feet long, with four to six coils of standard one-inch pipe installed for steam heating has been found to raise an average fifteen gravity fuel oil from 90 degrees to 170 degrees (the firing temperature). This was obtained with a normal oil consumption of from one to two barrels per hour. It must be remembered, however, that the ultimate temperature will vary according to the velocity with which the oil is pumped through the heater, as well as the pressure of the steam, and the entering temperature of the oil. No definite data can, therefore, be safely quoted concerning the relative sizes of this type of heater for desired outlet temperatures of the oil.

The rate of heat transfer occurring in such a coil is relatively low as compared with the others discussed heretofore. It is, therefore, a more expensive apparatus to operate, from a steam and heat economy point of view, though its first cost will in all probability be well under that of the cheapest of the more intricate types shown herein. With second-hand material, and plant labor, such a heater can be constructed for about fifty dollars. The receiver should always be fitted with a thermometer and air vent at the top, and a drain for condensed steam on the under side, provided the heater is installed horizontally as is usually best practice.

In this type of heater there is a greater possibility of leakage occurring at the pipe joints fault can be prevented considerably by making up all such joints with a litharge-glycerine paste. To clean out tar residue, or other waste matter which may accumulate, a live steam connection can be made at the air vent fitting, and steam blown through to exit via the bottom drain. Inasmuch as both heads are best fitted as flange connected, either of these may be removed rapidly and easily for more through cleanout, or repair to the heating coil.

Heating Coils for Oil Storage Tanks.—Due to the fact that fuel oils will in general be so sluggish in the storage tanks as to render pumping a difficult matter at normal temperatures, means must be provided for heating such oils in the neighborhood of the suction pipe to a sufficient degree as will enable proper pumping to be carried out. Such heating is usually done by coils as illustrated. The purpose of such coils, whatever their construction, is primarily to heat the oil just enough to enable it to flow or be pumped from the storage tank to the main fuel oil heater. It is only rarely that an attempt is made to heat the oil sufficiently for atomization in the tank and do away with the main heater. Such practice is common where a light oil is used, and in warm climates, but for the average grade of fuel oil on the market today, and under normal climatic conditions, it is best to heat in the storage tank only enough for ready pumping of the oil, allowing the main heater to function as it is intended to.

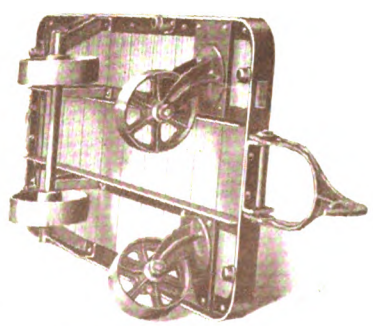
Heating coils for storage tanks are usually constructed as shown in the accompanying



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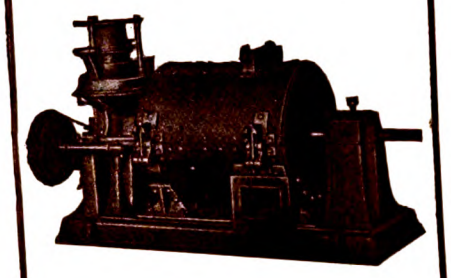
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illustrations. For the smaller capacity, horizontal tank a spiral coil surrounding the suction pipe has been found to give excellent results in heating the oil as it is drawn from the tank, and still avoiding waste of heat by heating the entire body of the oil in the tank. Exhaust steam, either from the oil pumps, the main exhaust line or the exhaust from the independent oil heater can be used in such a coil, and will be found to heat the oil sufficiently for pumping, whatever the weather conditions or the gravity of the oil. Except where a light oil is commonly used, or in very warm climates as has been stated above, such a method of heating should not be relied upon to heat the oil to a sufficient degree for atomization. With a circulating system the return oil, heated to firing temperature, should be led back to the storage tank via a vertical return pipe installed as close to the suction pipe as possible. Thereby heating of the suction will be increased and steam consumption for the coil decreased. Such a heater should be made of jointless, extra heavy pipe, tested to 250 pounds pressure. From six to eight square feet of heating surface will suffice, the over-all size of the coil being eight to twelve inches in diameter and about two feet high.

Another form of such a heating coil is shown in the illustration for a vertical cylindrical storage tank of larger capacity. The same type of coil is adaptable to a concrete tank. Such a heater should be located close to the bottom of the tank, set on an incline of supporting timbers. The slope should be about one inch per foot to insure proper drainage of condensed steam and to avoid stagnation in the coil and a decrease in heat transfer. For tankage averaging 25 feet in diameter, a 3-inch standard pipe coil will be ample to heat even the heaviest crude oil to a degree sufficient for proper pumping. All pipe joints in this coil should be made up with a litherage-glycerine compound to insure against leakage, and the inlet and outlet points at the tank shell should be connected by companion flanges fitting tightly with the same paste to prevent oil leakage.

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Stopping the Biggest Power Losses

(Continued from page 16)

He'll want to see them."

These are two plants, like which there are many others in the industrial field today. One is running hit-and-miss; the other has the benefit of intelligent supervision, based upon complete and continuous information on its efficiency of operation. The former is perhaps wasting 20 to 25 per cent. of the coal it burns, through lack of knowledge of the magnitude and location of its preventable losses. In the latter such losses are held to the minimum. When they occur, it is with the full foreknowledge of the management, who may judge it a matter of expediency to incur them, rather than undertake the measures of prevention immediately. Their presence is known and they will be wiped out as soon as possible.

The purpose of this article is not to go into detail of the losses common to boiler room practice and the methods of stopping them. That will be taken up at a later time. For the present we will be satisfied to point out what are the larger sources of loss in the boiler house, which react most readily to intelligent supervision and yield the biggest returns for the effort spent, where to locate them and to point out a few of the various types of instruments that are used for their detection.

The greatest source of loss in combustion efficiency in any boiler house is the gas that passes through the boiler tubes and carries large quantities of heat with it up the stack.

The amount of heat lost in this way depends upon the quantity of gases passing through the boiler setting and the temperature at which they leave the boiler.

It is essential, therefore, that the amount of gases must be no greater than is necessary for complete combustion, with the slight excess of air that is always necessary to attain that end. Any further excess of air does no useful work, absorbs heat from the hot burned gases, chills the furnace and the hot boiler surfaces.

Generally speaking, excess air comes from two sources, through burned-out spots in the fuel bed, and through cracks and leaks in the boiler setting. The best evidence of a fireman's worth is his ability to keep an evenly distributed fuel bed, covered with the proper thickness of coal. A bed that is too thin will let excess air pass through. Too thick a bed will result in a sluggish action, which is equally bad.

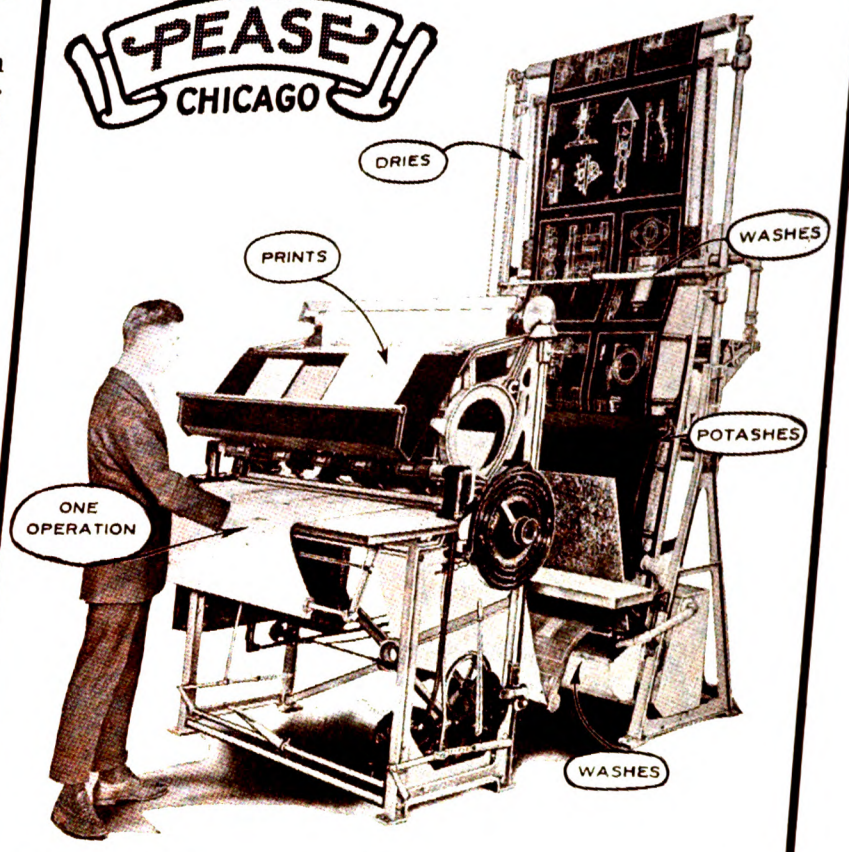
Cracks in the boiler setting are easily detected by inspection of the exterior brickwork. The air leak can be spotted by holding a lighted candle to the crack and watching the flame sucked into the opening by the current of air that is passing from the boiler room into the furnace. One of the best investments that can be made in the boiler house, from the standpoint of economy, is the coating of the boiler settings with a proper plastic cement "overcoat," making the setting air-tight.

Excess air cannot be seen, although its sources are quickly detected, once its presence is known. Reliable instruments are on the market, however, for detecting its presence and indicating the magnitude of the loss. CO_2 recorders they are called. They record the percentage of carbon dioxide in the flue gases leaving the boiler. The lower the percentage of C_2, the greater the excess air present.

The temperature of the gases leaving the boiler is also an important factor in the economical operation of the plant. This temperature must necessarily be greater than that of the water in the boiler, or no steam will be generated. There will, therefore, be a certain heat loss which cannot be prevented. Just how high this flue gas temperature must be, depends upon the design and type of boiler and the capacity developed by the boiler. Under heavy overloads the gases are being sucked through the boiler setting at relatively high velocities. The time of contact with the boiler surfaces is, therefore, relatively small. They cannot give up as much of their heat, as if they were passing through more leisurely. As a matter of course, therefore, we expect higher flue

(Continued on page 35)

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The labor saving element alone in the Peerless is a big feature. This combined with the low operating cost enables you to save the entire cost of the machine in a comparatively short time.

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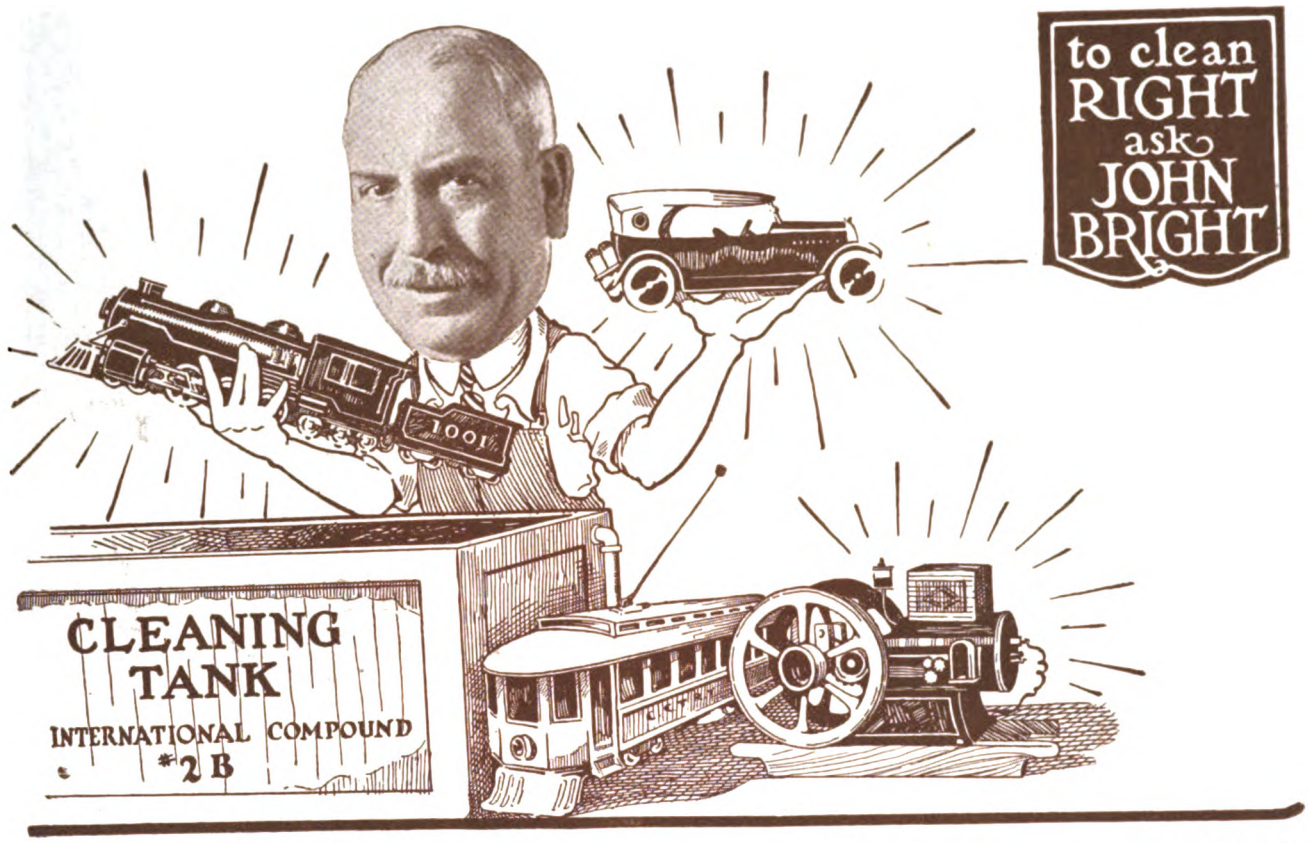
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THERE are a lot of folks who need an A-1 cleaner at the right price for heavy duty work. Our INTERNATIONAL COMPOUND 2B is just the thing for the dirtiest jobs.

Like all our cleaners, INTERNATIONAL COMPOUND 2B is entirely soluble and dry and gives great results in cleaning locomotive and street car parts, machine and automobile parts in repair shops, and all other work that has heavy coatings of grease, muck, paint and caked-on dirt. This cleaner has unusually long life in the tank and six to eight ounces to the gallon of water makes an excellent, low priced, cleaning solution.

INTERNATIONAL 2B recently saved one of our greatest railroads $250 every time a cleaning pit was made up. Another railroad tried 2B and doubled their output of cleaned work although using 33% less material.

Will you let me try to do the same for you? If INTERNATIONAL 2B does not do all we claim, your test will not cost you a cent.

Internationally yours,
John Bright

International Products
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INTERNATIONAL CHEMICAL CO.
PHILADELPHIA ~~~~~ PENNA.

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(*Continued from page 33*)

gas temperatures when the boilers are forced than when they are normally operated. This we cannot prevent.

But the exit temperatures will also depend upon the cleanliness of the boiler surfaces, both inside and out. We have discussed interior boiler scale in a previous article. Boiler tubes also become coated with an exterior deposit of soot and slag formed by the chilling of the gases of combustion, when they strike the relatively cooler tube surfaces. It has been found that this action is reduced to a minimum when the boilers are set high above the grates, so that the gases are completely burned before they strike the metal of the boiler. In modern plants, the distance from the under side of the front header is usually not less than 10 feet.

When the boiler tubes become coated with a heat-insulating deposit of soot, the gases pass through without giving up their heat as readily and they leave the boiler at much higher temperatures. Such deposits must be secured from the heating surfaces at regular intervals, either with a hand steam lance, or, better, by means of steam-operated, permanently installed soot blowers.

There are many types of temperature measuring instruments for indicating and recording the temperatures of flue gas as it leaves the boiler setting. Each type has its advantages and gives positive information as to the condition within the boiler setting.

There is another common cause of high flue gas temperatures which we have not spoken of, namely, broken baffles. These baffles are usually of brick placed between the banks of tubes in such a way that the gases are deflected across the tube bank several times before they finally leave the boiler. Occasionally a brick will become cracked or loosened and falls out of its place, permitting the gases to shortcircuit through the setting without following their otherwise tortuous path. The result is that the gases are in contact with the boiler surfaces only a relatively short time and they leave the boiler at much higher temperatures.

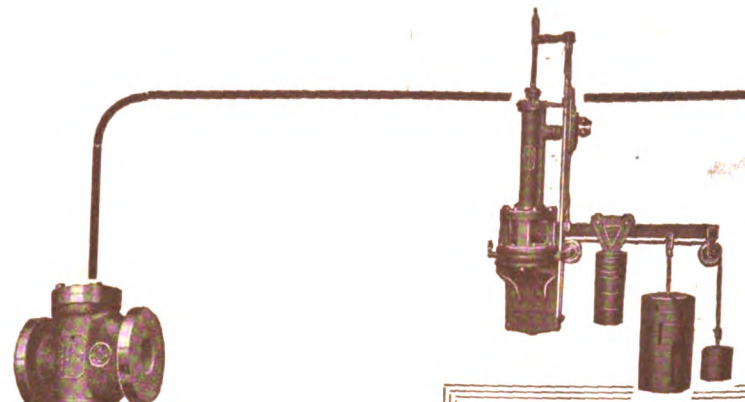
Suitable temperature indicating and recording instruments, therefore, indicate an excessive loss from these causes, which can be remedied at the proper time.

In actual operation, there is always a relation between flue gas temperature and percentage of CO_2 in the flue gases. When the CO_2 content is high, the chilling effect of excess air is a minimum (since the excess air itself is a minimum) and the flue gas temperature is correspondingly high. It is always economical, however, to increase the CO_2 (which means decrease the excess air), in spite of the fact that it results in a higher exit temperature of the gases.

Many engineers believe that the rate at which they can burn coal depends solely upon the air pressure through the fire bed. Such is not the case for, if so, a thick bed of ashes would burn as fast as a thick bed of coals, if we had the same draft conditions. The combusion rate of a fuel, therefore, depends also upon the

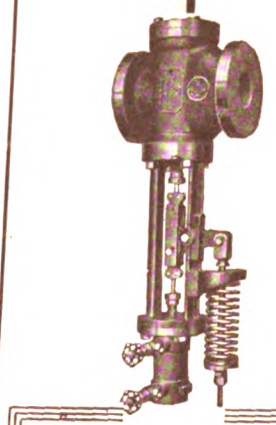
(*Continued on page 37*)

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Mason Hydraulic Damper Regulator

Assures accurate regulations of boiler pressure—Double Acting — positive movement and actuated by water pressure in both directions. Equipped with 2¼ in., 3 in., 4 in. and 5 in. diameter operating cylinder.



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For controlling steam-driven boiler feed pumps. Size ½ in.-1½ in. bronze body. Size 2 in.-4 in. iron body, bronze mounted.



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Reduces and maintains even pressure of steam and air regardless of the variation of the initial pressure or of the volume of steam and air required. Sizes ½ in.-2 in. bronze body. Sizes 2½ in.-10 in. iron body, bronze mounted.

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They aid the management by keeping costs down and help in maintaining better efficiencies.

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AT ELLIS ISLAND, in New York Harbor their hoisting problem involved the raising of containers of garbage ranging up to 350 lbs. from boiler room floor to top of incinerator. This refuse is accumulated from the good meals served daily to 3000 persons. They had been using a winch, but with unsatisfactory results.

The Model B non-telescopic Hoist as installed for this special duty makes it possible to dump the garbage into fire opening *without rehandling* at top of incinerator. The container is swung by the revolving crane *directly into position* over any one of the four openings. The official in charge is well pleased with G & G performance.

Your own hoisting problem is probably quite different, but if you will tell us what it is, it is likely we can help you solve it so the loads (under 1000 lbs.) will be handled quickly, safely and economically.

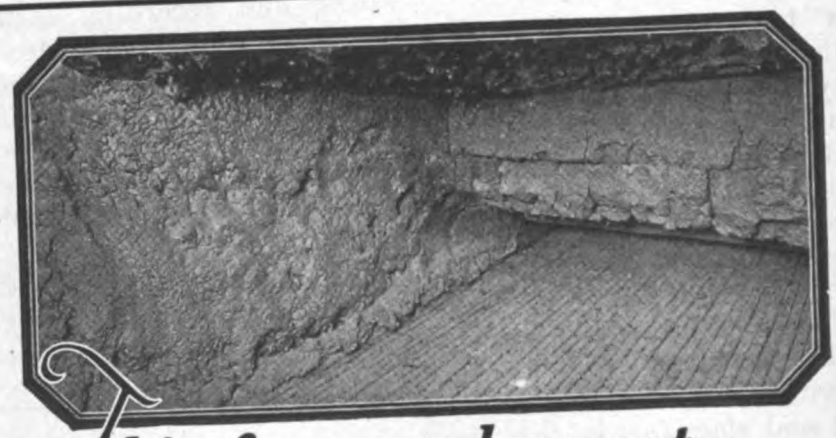
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Telescopic Hoist

with Automatic Gear Shifting Brake Device and Silencer



This furnace has not been relined in four years

AT the Otis Building, Chicago, there had been much trouble with fire brick linings. In the words of Charles Langs, the chief, "troubles and repair periods crowded on each other's heels so fast that we hardly knew whether we were keeping up steam on coal or brick."

Then four years ago, under four Edge Moor Boilers, they installed Plibrico.

These linings of jointless Plibrico have never been replaced. As Mr. Langs says "we have made practically no repairs and they promise a lot more of the same kind of service."

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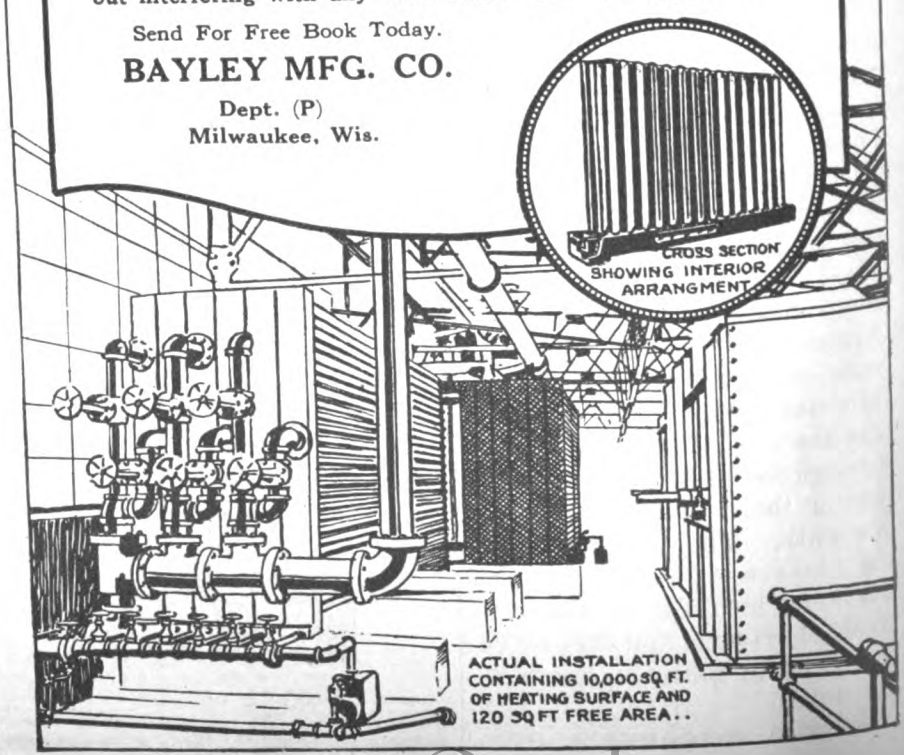
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(Continued from page 35)

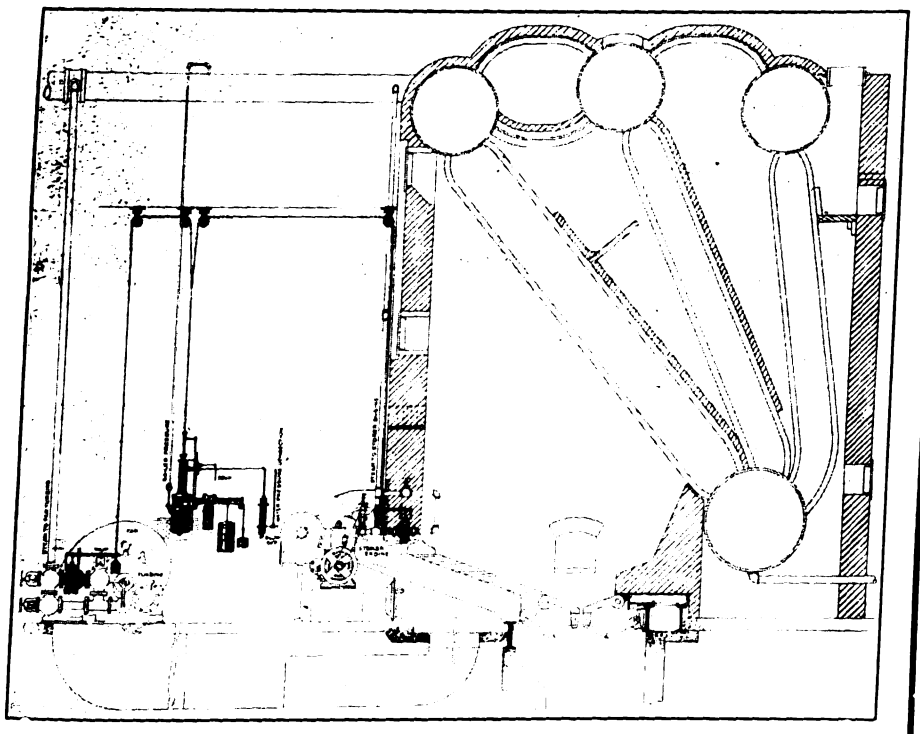
per cent. of CO_2 in the furnace gases, *i. e.*, upon the efficiency of combustion. By decreasing the excess air supplied, therefore, we can actually increase the capacity of the boiler. In some cases, in fact, the need for additional boiler capacity has been nullified by increasing the combustion efficiency of the entire plant.

Another source of loss in efficiency consists of the unburned coal that finds its way to the ash pile. The amount of this loss depends primarily upon the quality of the coal itself. It is easier to clean fires where a low-ash coal is being burned than where a high-ash coal is used. It is inevitable that some coal will find its way to the ashpit. When the loss is excessive, it may be due to lack of care in cleaning, undue haste in burning fires down before cleaning or to faulty, leaky and burned-out grates.

The necessity for knowing accurately the quality of coal delivered to the bunkers is apparent, since it is impossible to know if the ash loss is excessive or not without knowing what the coal itself is like. Furthermore, it is not sufficient to know how much heat you can get out of the coal, but also how much heat was in the coal in the first place, if worth while figures are to be obtained on the operation of the boiler house.

Obviously, in comparing economies and efficiencies from month to month the only fair basis is the ratio of the heat units input to the heat units output. This affords but another reason for knowing what kind of coal you are getting, as well as how much. Pounds of water evaporated for every pound of coal burned does not mean anything, since, obviously you may have a very good coal one month and a very poor grade the next.

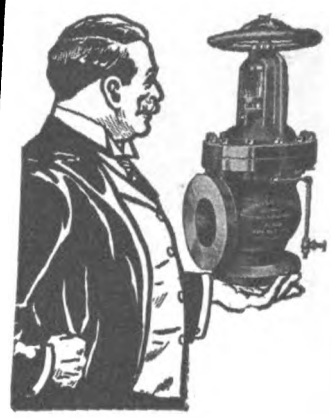
These statements should not be interpreted to mean that coal and water figures are not desirable or necessary. They are *both*, and suitable means should be provided for obtaining them. But they are only half the story.



In a subsequent article the subject of boiler room losses, records and economy will receive a more detailed treatment than has been possible in the limited space allotted to this article. At the present time it has been the writer's intention merely to describe the two major losses involved in combustion efficiency, their causes, how they were detected and stopped. It will be necessary to leave for the future the matter of analyzing all boiler room losses, keeping complete boiler room records and interpreting all the information gained with the view to increasing the economy of operation.

No Power Plant Manager Would Gamble With the Lives of His Boiler-room Men

Certainly Not—



because if men are killed or maimed and the plant is wrecked it is then too late to think about good safety equipment—because if backflow of steam into a damaged boiler or a terrible pipe explosion took place, lives might be lost and a large capital investment wiped out—

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8. Double Corliss Dash Pot that cushions in opening and closing.
9. Cannot pound, spin, stick or chatter.

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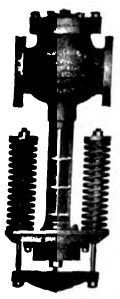
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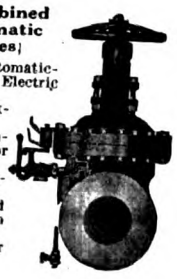
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2. Perfectly Cushioned by water and air. No metal-to-metal seats.
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4. Operates quickly or slowly as required—No attention necessary.
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6. "Always Ready for Service."

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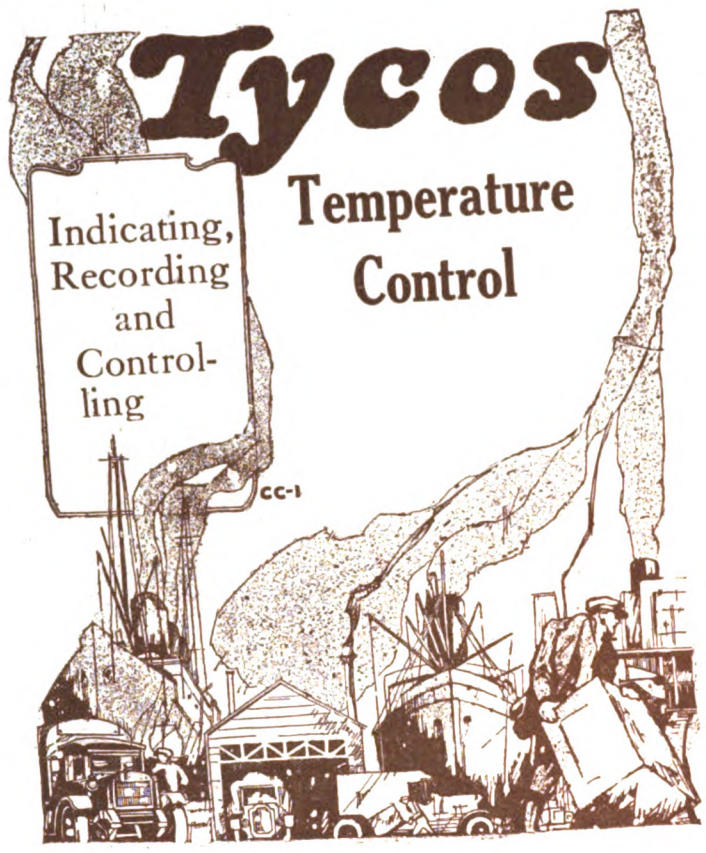
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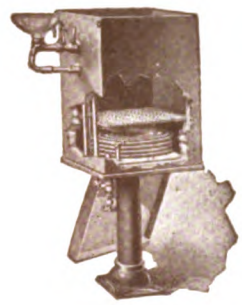


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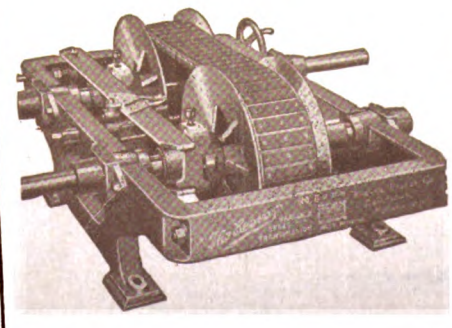
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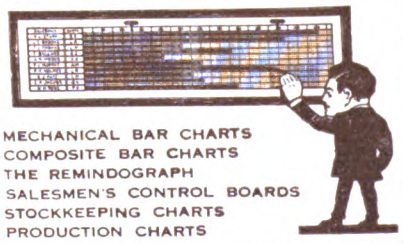
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By H. M. Brayton, M. E.

Research Engineer, Picatinny Arsenal

THE object of any kind of inspection should always be to insure a desired quality of product and uniformity. It depends a great deal, of course, on the product manufactured and the degree of perfection desired how much inspection is required. If the reputation of the company and its product depends entirely upon quality, the inspection must be very carefully done and no expense must be spared reasonably to insure the standard which has been set. On the other hand if the product is cheap and appeals to the public purely on that basis and the public does not expect high quality, then inspection can be made less. This point is one which only the individual manufacturer can determine.

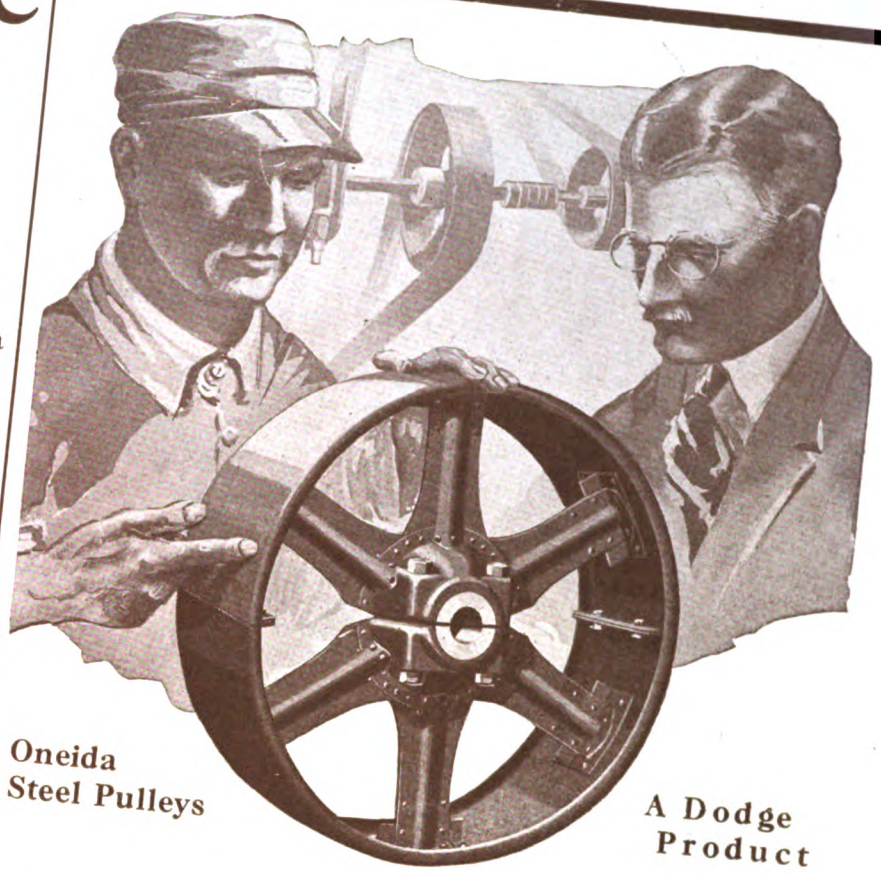
It is probably true that the inspection in many plants is inadequate and not properly handled. In large plants where the product changes but little from year to year inspection becomes a mere matter of routine and gages can be made for every part. Cheap labor can be employed on the work and the cost is relatively low. In smaller plants, however, where the product or products vary, the problem is quite different and the manager or owner must decide in each case how much inspection he can afford to give the material made. He must think of this when he bids on the work and takes the contract. If the parts are those of a complicated mechanism he must make sure that each part has proper tolerences given on each dimension which are in accordance with good machine shop practice. If they are not, he should call it to the attention of the purchaser and if the latter still desires to have the close tolerences held, make the bid cover a possible excessive rejection on this part. It often happens that closer tolerences are specified on a drawing than are really needed and if the purchaser realizes it he will gladly change it to avoid extra cost.

Inspection in many small shops is handled directly by the foreman or assistant foreman. It may be taken care of by a so-called floor inspector. This latter individual is practically always responsible to the foreman. Therein lies an error in management. The same man, no matter who he is, should never have charge of inspecting the material which he has charge of making. The temptation to pass things slightly defective is too great. Every shop should have a chief inspector and as many men under him as are necessary to do the work properly and he should be responsible to the head of the firm or the manager. This is the only way in the majority of cases to obtain a good product.

Naturally foremen who have been brought up under the system of inspecting their own work do not like to have this function taken from them and sometimes they consider it a reflection on their integrity. It is, however, no reflection on the foreman to have the inspection handled by a separate department as there are few men in whom are combined the qualities of a good foreman and a good inspector. The points of view are quite different. One is trying to produce quantity and the other to insure quality. These are not always compatible.

Inspection in the small shop where only a few of each article are made is often a most difficult job. The quantity being made does not warrant the making of proper gages, and the inspector is forced to check the parts with the various measuring tools. Sometimes this is a difficult matter, though right, and calls for the use of a certain amount of mathematics especially trigonometry and geometry. This kind of work naturally calls for a high grade

(*Continued on page 43*)



Oneida Steel Pulleys

A Dodge Product

"That grooveless oval crown saves us a lot of power"

TAKE any angle crown pulley and lay a belt on it. Note the absence of contact at the center of the pulley face where tension is greatest. Then try the same test on the Oneida. The belt hugs the oval crown providing contact all over the face. This permits loose belts—saves power—prolongs belt life.

Oneida pulleys are light—no superfluous pulley weight on lineshaft. They are strong enough for any service—easy to erect because of the split feature and grip the shaft securely.

On your next order for steel pulleys specify Oneida. Your local dealer can make immediate delivery.

DODGE

Power Transmission Machinery

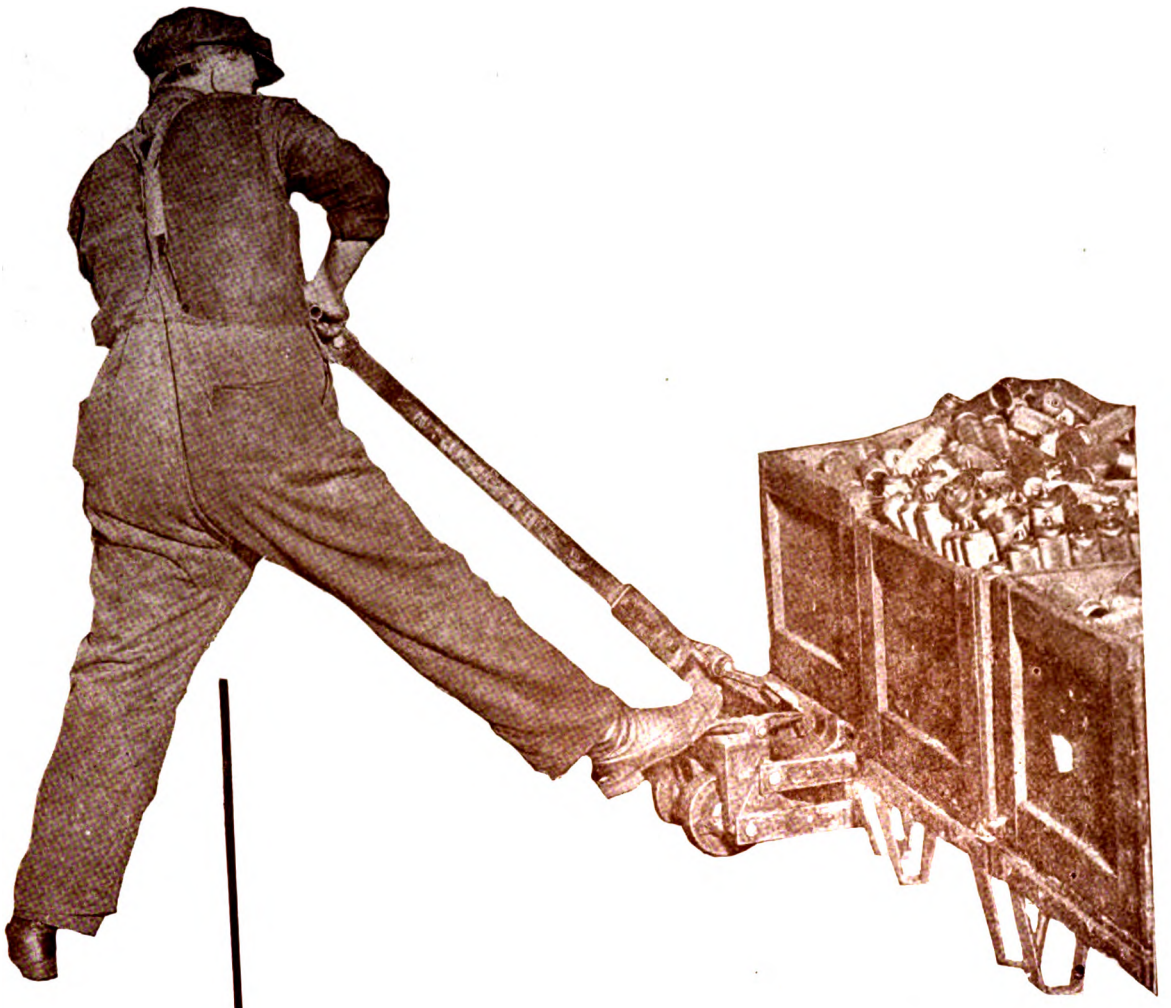
DODGE MANUFACTURING CORPORATION

General Offices: Mishawaka, Indiana. Works: Mishawaka, Indiana, and Oneida, N.Y

Dodge Manufacturing Company of Canada, Ltd., Toronto and Montreal

New York, Boston, Philadelphia, Pittsburgh, Atlanta, Cincinnati, Minneapolis, Houston, Seattle, St. Louis, Chicago, San Francisco

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From Storage, the "Alemite" cylinders go through several machining operations and then are knurled.

Distance from last machining operation to knurling machine, 132 feet. *Time required to lift, haul and set loads with Stuebings,* 55 seconds.

Distance from knurling machine to washing and plating room, 165 feet. *Time required,* 70 seconds.

Distance from plating room to Stock Room, finished parts, 315 feet. *Time required,* 2½ minutes.

Distance from Stock Room to Final Assembly tables, 66 feet. *Time required,* 26 seconds.

Distance from Final Assembly to Shipping Room, 196 feet. *Time required,* 98 seconds.

Stuebings cut interior hauling time until it can be figured in seconds

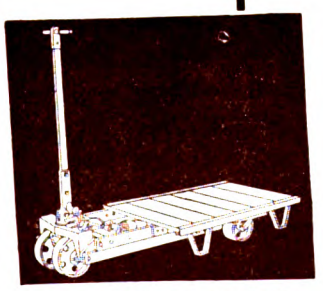
The Bassick Manufacturing Company of Chicago, manufacture "Alemite" Lubricating Systems—an assembly of comparatively small parts requiring many operations. The "progressive" method of manufacture is employed.

From storage shed to first operation, then to second, to third, and on through the various departments until the finished product is delivered to the shipping room, there's *not a lost motion or a wasted minute*, in the lifting and hauling of material with *Stuebing Lift Trucks.*

Trucking labor is cut to the minimum.

One man does the work of five with ordinary trucks. All rehandlings are eliminated. Parts are taken from platforms, machined, and replaced on platforms. Loaded platforms are lifted, hauled varying distances, and conveniently set, with Stuebing Lift Trucks—*and the time required is measured in seconds!*

There is a uniform activity throughout the plant. The flow of materials is constant, even, *sure*. This is the method of material hauling you need in *your* plant. Write us today—a Stuebing representative will tell you about it.



Stuebing Steel-Bound Platforms match the Stuebing Lift Truck in strength of build and adaptability of service. They won't wear down or wabble.

The Stuebing Truck Company
Cincinnati, Ohio **Montreal, Que.**

StueBing
LIFT TRUCK SYSTEMS

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(Continued from page 41)

of inspector and the small manufacturer who desires to make sure that his product is right should not attempt to put a cheap man on such work. A good inspector who is on his job has a good moral effect on the workmen and foreman in the shop because they know they can not get a defective part by him. They will do their work better and for this reason alone, if for no other, it pays to put the proper man on such work.

When the part being made is one piece and expensive it is often well to have it checked by the inspector after each operation. In this way work is not wasted on a piece after it has been spoiled. The nature of the product and the amount of rejections will soon show the manufacturer how far he should carry this.

In addition to the regular inspection department, where all parts should go for acceptance after they are made, it is often well to have floor inspectors who may be under the foreman to occasionally check the work in the machines to see that the set-up has not changed. An automatic may start out at the beginning of the day doing perfect work and before noon be off just enough to spoil the work. It is true that the operator should check his own work at intervals but experience has shown that he can not be relied upon to do this. A floor inspector can catch such a condition and his presence will also act to keep the operator on his job. The floor inspector can also relieve the foreman in instructing the men how to do the work.

When drawings are issued to the shop a duplicate set should be issued to the inspection department. These drawings should be law to both the shop foreman and the chief inspector. The shop foreman should turn over to the inspector everything that is made but if he knows certain parts are defective and not according to drawing he should so tag them. The inspector's report will then show the total work produced and the amount accepted. The inspector in no case should be permitted to use his "judgment" in accepting material which is not strictly in accordance with the drawings. Inspectors are seldom capable of making such important decisions. They should reject anything and everything which is not right and the report of rejections and the causes given to the manager. The manager should then call a conference with representatives from all departments concerned, such as the engineering, cost, sales and manufacturing departments. This conference should thoroughly go over the matter of rejection and decide whether the defective parts are to be accepted. It may happen that the defects are trivial and will not affect the parts for the use intended. On the other hand the defect might seriously affect functioning or reflect discredit on the sales department who may have been making a point on quality. The manager should sit at the conferences if possible or at least review and approve of the board's recommendations. The data thus obtained will be of value to the sales department in making prices for the next order.

(Continued on page 45)



StueBing

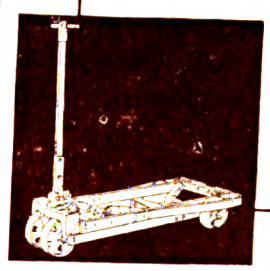
Adopts Timkens

The Stuebing Truck Company, makers of the famous Stuebing Lift Truck, now use Timken Tapered Roller Bearings.

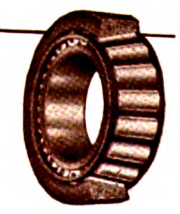
Their Factory Manager, Mr. W. R. Stuebing, says, "We adopted Timken Tapered Roller Bearings only after a careful study of what we believe to be essential for heavy duty and long life. We found that the Timken Bearing not only showed easier operation and economy, but its cost of maintenance was extremely low."

Timken Bearings mean better lift trucks—(1) because of the obvious labor saving effected by easy-rolling Timken-equipped trucks, which require lubrication only once or twice yearly; (2) because of the dual-duty ability of Timkens to carry not only radial loads, but also thrust and resultant loads; (3) because of the safety of perfectly-aligned Timken-equipped truck wheels; and (4) because when inevitable wear finally does occur, Timkens can be adjusted to function as when new.

The Timken Roller Bearing Co
CANTON, OHIO



One man rolls a Stuebing Lift Truck under a loaded platform, lifts it with an easy pull on the steering lever, quickly moves it to any location, and safely lowers it to the floor.

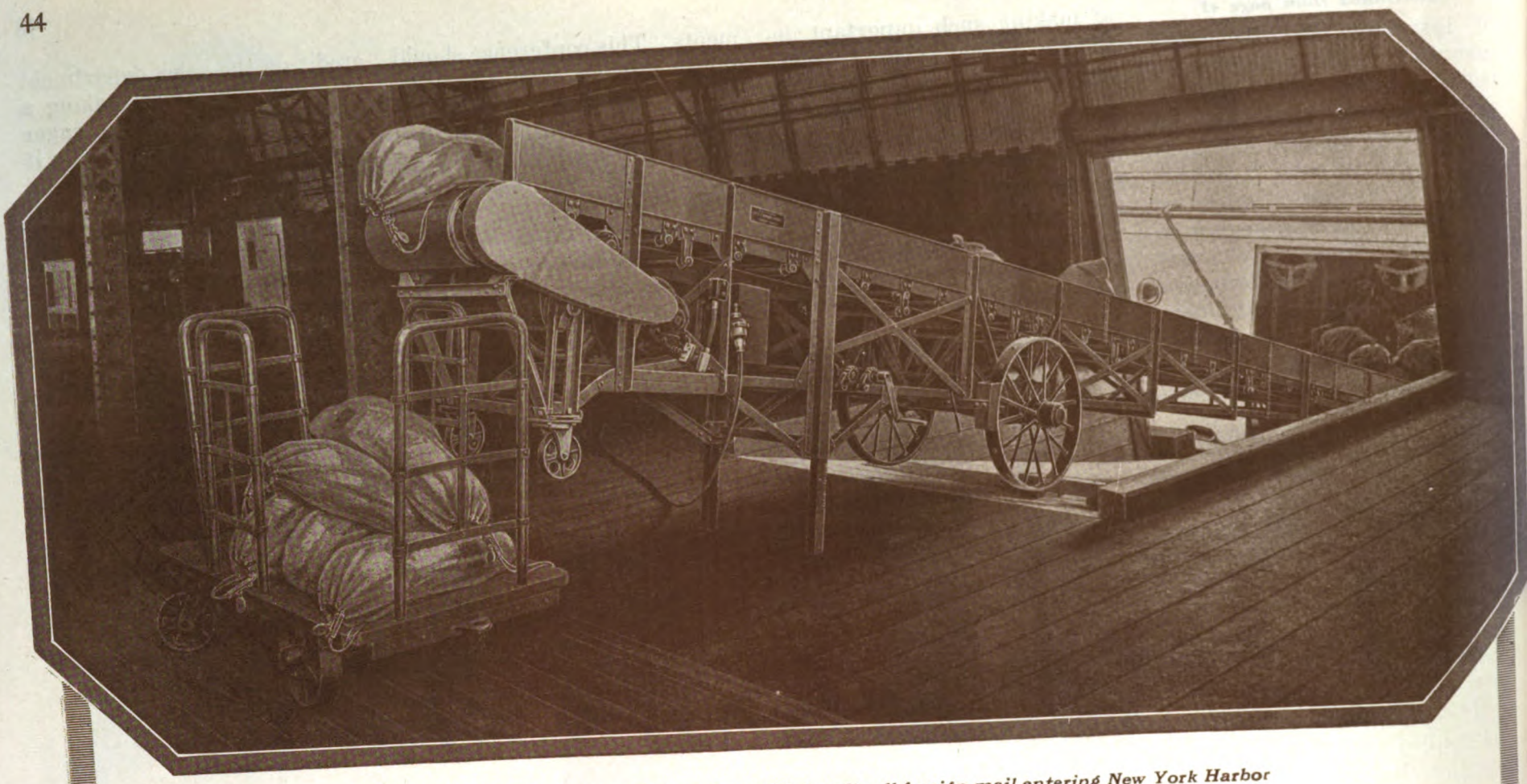


TIMKEN
Tapered
ROLLER BEARINGS

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One of a battery of Portable Conveyor units which handle all foreign mail entering New York Harbor

Have you given the question of Material Handling in your establishment the proper consideration?

It is a big problem worthy of your serious thought because so much depends upon how you handle materials. Take for instance the selling price of your product, if you are a manufacturer. Production without any question determines it. Conveying systems are the means of establishing and controlling production, inasmuch as they keep materials on the move continuously, so that all productive machines and assemblers produce to their utmost capacity.

The cost incident to the receiving and storing of raw materials as well as the shipping of finished product effects the selling price of your product. Rather than the slow moving elevators or trucks requiring attendants, materials can be elevated, distributed and lowered by automatic conveyor units with far greater rapidity at an insignificant cost.

Are you satisfied that your material is being handled properly? Are your operators and assemblers supplied with material? How much time is required to load cars or trucks? How long does it take to unload and distribute a car of raw material? If the remotest doubt exists in your mind allot a few hours to a survey of methods used.

We will gladly have one of our engineers make an analysis of your material handling problem and advise the type of Conveying System which will reduce your handling costs to a minimum.

SAMUEL OLSON & CO.

Loose, Bulk and Packed MATERIAL HANDLING SYSTEMS

2418-26 Bloomingdale Ave.
CHICAGO, ILL.

5th Ave. Bldg.
NEW YORK, N. Y.

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(Continued from page 43)

Interchangeability of parts is probably one of the greatest reasons for American success in manufacturing, now grown to such huge proportions. Without this standardization this great volume of business would not be possible in many lines. The day has come when the small shop has been compelled to fall in line or be forced under by the tide of larger competition. Often the small shop exists on orders received from large concerns which represent the overflow and save the large concern from having equipment to take care of the peaks of business. In such a case the small shop may work on parts which go with other parts to make up a complete machine. These parts must be made correctly and according to drawing or they are not wanted. A good inspection force is then a great asset to the manager. A reputation for accuracy is worth money to any firm but is especially valuable to the small shop.

Competing with the Cheapest Labor in the World

(Continued from page 9)

tance of 24 miles on one battery charge. Calculations were made by the municipal council of Shanghai and proved that this electric industrial truck could replace coolie labor at a very considerable saving. The calculations including interest, depreciation, driver's wages and cost of current show a cost of from 30 to 36 cents per cubic foot as compared with a cost of 90 cents for the much slower coolie-wheelbarrow method. Given the proper roadway conditions the showing would have been much better but as coolie and industrial truck operated over the same ground side by side the comparison is fair. The electric industrial truck won the competition with the cheapest labor in the world.

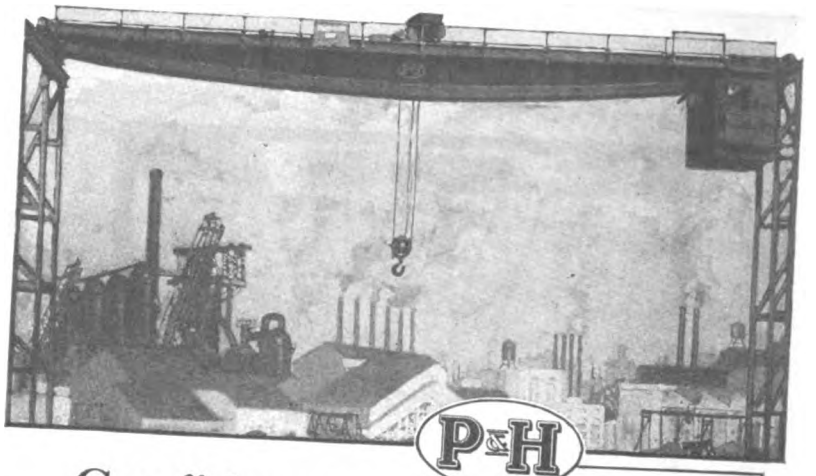
It has become an axiom with American engineers, and proved time and time again, that a good concrete road in connection with an industrial truck installation will pay for itself inside of a year. It is not unusual for such an installation to pay for itself within six months.

In China the industrial truck must meet competition from hand carts and the cheap coolie labor. The coolie can carry very heavy loads for considerable distances when it is put on his shoulder by a loading coolie, but give him a light load and he falls all over himself in handling it. Their inefficiency through loss of time taken to talk and argue among themselves is very great. Then, too, they must guard against the evil spirits who rupture them, and the hollering they raise to drive these evil spirits away together with their superstitions along other lines is not to be ignored.

In carrying loads with a bamboo pole and sling, the load is lifted only a few inches from the ground. This is the common method of carrying loads up to 800 pounds and only two men are required. Four men carry twice this load and their pay is only a few coppers a day. It is competition of this sort that the industrial truck has had to meet and it has shown that on short hauls, even though the loads be very heavy, coolie labor is the cheaper. However, on the longer hauls, as in the instance noted above as well as in and around warehouses and on the docks, industrial truck, tractor and trailers have proved their value.

In Japan and Manchuria, which is under Japanese control, will be found hundreds, yes, thousands of American-built chain blocks and electric hoists and some really good installations of American-made industrial trucks. With the importation and construction on the ground of heavy industrial machinery and much railroad equipment, it is not inconceivable that chain blocks and electric hoists should find a number of uses. In connection with the use of industrial trucks there is much missionary work to be done. The railroads, the government and a number of the larger industries are making a careful study of the uses and advan-

(Continued on page 47)



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Confidence

As an outgrowth of years of P & H performance since 1884—complete confidence has been established.

P & H dependability has been demonstrated over this long period of time—dependability not only in long, unimpaired service of P & H products—but also in the P & H organization.

With the development in the art, the new features incorporated in P & H cranes have always been accepted with confidence by the industrial executive and engineer. One recent example of this development is the elimination of lost time due to slow lowering of light hook.



P & H QUICK-LOWERING RELAY

As auxiliaries to P & H Traveling Cranes and for buildings with low overhead—P & H Electric Hoists are extensively used for general material handling. The P & H Portable Crane on Corduroy Traction driven by gasoline or electric motor has also come into increasing usage about the industrial plant.

P & H Quick-Lowering Relays Eliminate Wasted Time

Apart from their inherent qualities, P & H Cranes have the distinctive quick lowering feature—the result of a patented Relay—which saves many hours per week, and gives the user crane service that is practically equivalent to a crane and a half for each crane.

P & H Cranes have been conceded leadership—the responsibility of which is thoroughly appreciated.

Bulletin mailed on request.

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PAWLING & HARNISCHFEGER CO.

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WHEN you buy Hoists—Buy the Wright High Speed.

It's the most reliable, speediest, safest, and easiest operated one-man hoist that you can get.

All steel constructed with large overload capacity.

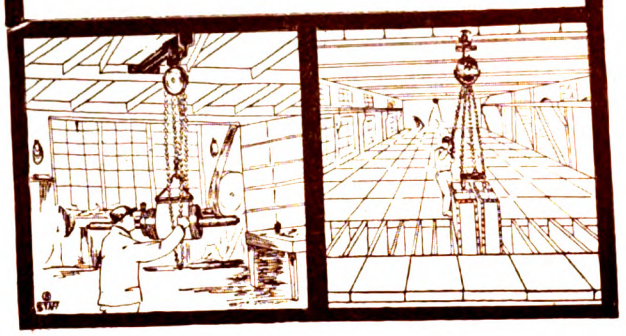
Built in sizes from 1 to 10 tons.

Investigate and be convinced.

We have the proof. Shall we send it?

WRIGHT MANUFACTURING COMPANY

Lisbon, Ohio



NILES CRANES



Save time—Save labor—Save space with modern crane equipment

THE FOUNDRY is an example of a shop where several of the types of Niles Cranes can be combined to secure the utmost efficiency in the saving of labor and time.

The wall cranes shown take care of the various needs of the floor moulders in lifting and turning their flasks for them during molding operations. This leaves the overhead traveling crane free for the heavier and longer travel work of removing finished castings, bringing in molding materials, loading trucks or cars with castings and transporting molten metals during pouring operations.

The control of a crane that handles sizzling, white hot metal must be precise and absolute. One failure would be too many. This is one of the features upon which the reputation of Niles Cranes is built.

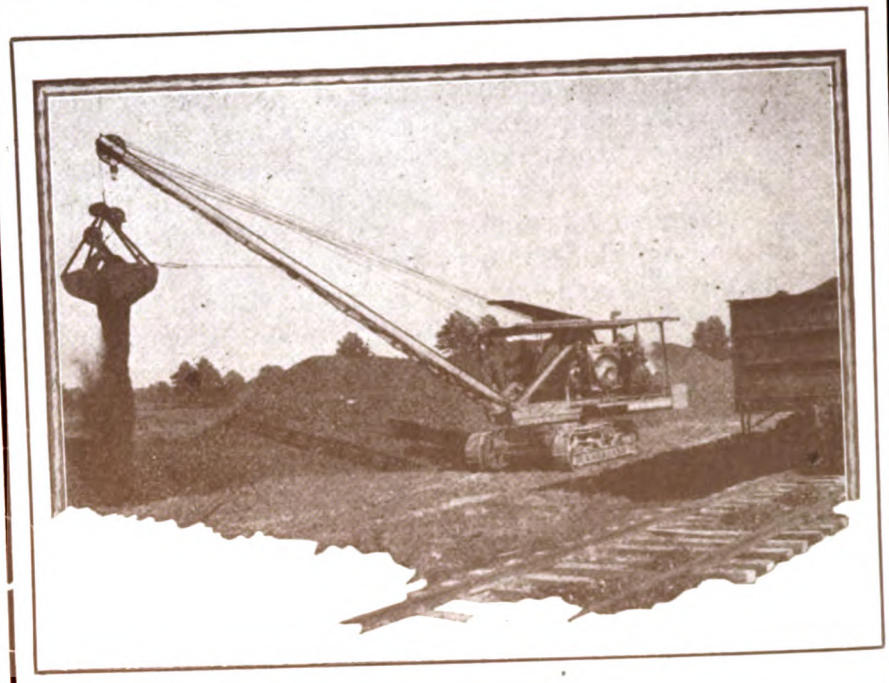
For the Steel Mill Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy materials must be handled with speed, safety and economy.

NILES-BEMENT-POND CO.

111 BROADWAY — NEW YORK CITY

CRANE WORKS— PHILADELPHIA, PA.

No. 3 *of a series illustrating the many industries served by Niles Cranes.*



Gasoline Powered— Always Ready to Run.

High flexibility of power, simplification of mechanism and control make it a popular machine with every man that has used it—there are no fires to pull, no dials to watch—it is always ready to run and it always runs when the operator is ready.

Let us tell you what Northwests are doing now—and what they will do for you.

Write for the complete story

NORTHWEST ENGINEERING CO.

1231 Steger Bldg., Chicago

NORTHWEST CRANE DRAGLINE SHOVEL

GAS OR ELECTRIC

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(Continued from page 45)

tages of industrial trucks. The reports of foreign engineers who have travelled this country leave no room for speculation as to the time railroads, warehouses, ship companies and large industrial plants will be active industrial truck users. That time has arrived, but the Japanese will act slowly. The Japanese technical men have gone into this subject with considerable thoroughness. Fleets of American-built trucks, tractors and trailers are now being used by the Imperial Government Railroad and the South Manchurian Railroad, as well as by the larger steamship lines. The best installations are to be found in Osaka, Tokyo and Dairen. Platform trucks of the standard and drop platform types, tractors, trailers, crane trucks and elevating platform trucks make up these fleets. They are used at the water front on the docks, around the warehouses and in the railroad terminal yards, to do much the same work that they are put to here in the United States. The electric industrial truck has met the competition of coolie labor and hundreds of donkey carts. It has proved its value where the load was heavy, the haul long.

India, as might be expected, presents a none too fertile field for the introduction of materials handling equipment. But in the larger sea-port cities both chain blocks and electric hoists and even industrial trucks have found their way. The warehouses, railroads and larger industrials are practically the only users.

The work of the American and European engineers is one of continuous education in teaching these people the economy of materials handling equipment. But, the market is there in spite of the labor conditions which are the direct opposite to our own, and when these people are shown by actual demonstration the advantages and economies of the Occident's method of industrial transportation they are certain to recognize these advantages and adopt them.

THE United States Government sanctions working conditions that would not be tolerated by private employers, it is declared by the Federated American Engineering Societies, which appeal for a Federal safety program.

"The Government should, in its industrial plants, set an example to private employers, by providing for its own employees working conditions which are safe, hygienic and sanitary," says the statement issued by the engineering federation and prepared by Morton G. Lloyd, vice-president of the American Society of Safety Engineers, and member of the Board of Councillors of the Eyesight Conservation Council of America. Mr. Lloyd is chief of the Safety Section of the U. S. Bureau of Standards.

The engineers assert that these evils have been pointed out by Congressional Joint Commission on Reclassification of Salaries, but no remedy has been applied. Federal safety standards were drawn up during the war, it was said, but there is no officer with authority to enforce them.



How N. Y. Subway Could Pay the City $48,837

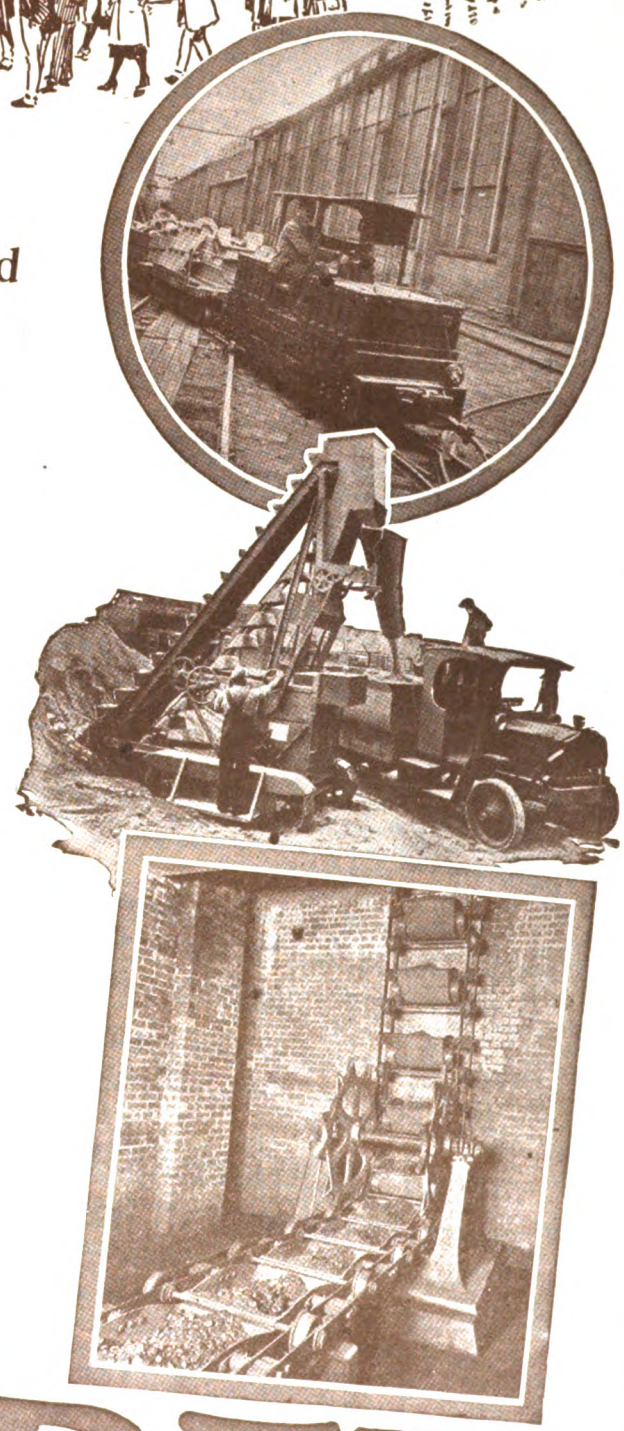
Great interest was manifested by the announcement that the City of New York would receive $48,837 as its December share of the net profits of the Interborough Rapid Transit Company—that a deficit of $194,000 in the last quarter of 1921 had been turned into a profit of $216,000 in the same period of 1922 in spite of an increase in the cost of coal of $669,000.

This is largely due to economies effected by the installation of various modern appliances—turnstiles, multiple-unit door control, etc.

The big lesson this saving teaches every executive is ECONOMIES CAN BE EFFECTED BY ADOPTING MODERN MACHINERY.

This is especially true in the handling materials—and Jeffrey Equipment has demonstrated it in hundreds of installments.

Jeffrey Material Handling Machinery includes a complete line of: Conveyors of various types; Chains; Bucket elevators; Portable Loaders and Unloaders; Portable Belt Conveyors; Coal and Ashes Handling Equipments; Industrial Locomotives; Crushers; Pulverizers, etc.



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STEEL LIFT TRUCK PLATFORMS



Save Renewals and Repairs on Lift Truck Platforms BY USING THE "HALLOWELL"

From time to time the all wooden construction must be repaired, and finally complete replacement is necessary, therefore, the initial investment is only a small part of the ultimate cost.

The robust design of the "Hallowell"—heavy steel angles and steel leg holders being securely joined by hydraulically driven rivets—renders it practically indestructible and, therefore, a very profitable investment.

Ends of runners are flared, as shown by above illustration, an exclusive "Hallowell" feature, which greatly simplifies entering the truck.

The value of this feature is soon realized by the workman after platform is put into service.

STANDARD PRESSED STEEL CO., JENKINTOWN, PA.

(The "Pioneer" Steel Hanger People)

INVESTIGATE

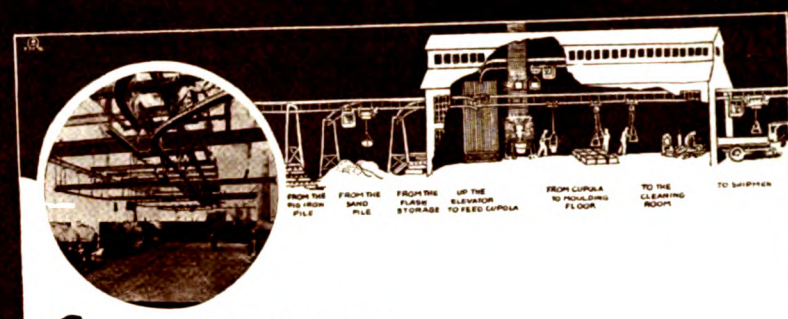
STANDARD PRESSED STEEL COMPANY, JENKINTOWN, PA.
Gentlemen: Kindly send me full details and prices of "Hallowell" Steel Reinforced Platforms.

Name .....

Company .....

Address .....

Truck used .....



CLEVELAND TRAMRAIL SYSTEM

HAND-OR-ELECTRIC

We are also Specialists in Appropriate Carrier and Grab Designing

It Works "In" and "Between" Every Foundry Operation

As *flexible* in its application and installation as a wheelbarrow yet never in the way.

Safer than any known method—quick and efficient.

Can be *installed quickly* and without any interference with your present methods of production.

Used in some of the largest as well as smallest foundries in the U. S.

It is the one system that will allow you to *cut down your costs.*

Our Engineers would be very happy to look over your plant and submit figures.

Shall we send them?

CLEVELAND ELECTRIC TRAMRAIL

DIVISION OF

THE CLEVELAND CRANE & ENGINEERING CO.

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Which Installation Next?
Cleveland Tramrails are Lowering Production Costs in Every Conceivable Industry. Your Problem if not already Shown, will appear in these Inserts
Watch Them

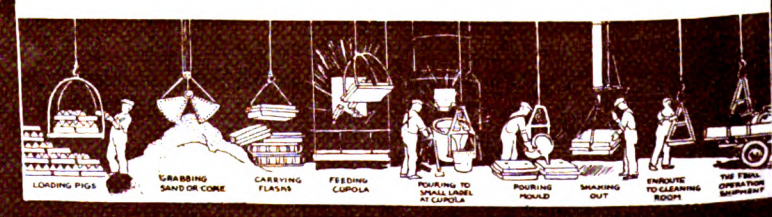
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Handling Parts and Packages

(*Continued from page 23*)

box as large as that shown in figure 8, which shows an open center type spiral chute.

The closed center type of chute occupies a minimum amount of floor space. The operation of this chute is simple, and effects enormous savings. A package descending such a chute will be forced against the guard rail, its speed being controlled by the friction on both the runway and the guard rail. The heavier the package, the faster it will tend to move. Consequently, the more firmly it will be pressed against the guard rail, and its speed will be reduced. These chutes can be loaded from any floor, and exits can be made from the chute to any floor.

Figure 8 illustrates the proper method of loading the spiral chute at intermediate floors, and shows how easily these chutes are fitted with fire doors at all floor openings. It will be noted that a freight elevator is located in the background of figure 8. The use of the spiral chute makes it possible to lower goods much more quickly than could be done with a freight elevator. Therefore, the elevator is used mainly for raising material between floors.

While figure 8 shows simple spiral chute construction, figures 11 and 12 show more complicated installations. That shown in figure 11 is the discharge end of a double blade spiral chute for handling mail sacks at the Post Office Terminal, Pittsburg, Pa. It is so constructed that two individual spiral chutes are carried on one center post, and through one floor opening. Where materials have to be segregated, this type of construction is cheaper in installation cost than two spiral chutes. A similar installation (figure 12) at the Union Terminal Post Office, Chicago, shows the method of feeding a multiple blade spiral chute from various overhead conveyors.

These illustrations show what it is possible to do, both in the feeding and unloading of spiral chutes. Frequently materials are too fragile or bulky to be handled in this type of chute, and in these instances it is recommended that gravity roller spiral chutes be installed. Figure 9 shows two spiral chutes for handling cases of bottles between floors, and illustrates the method of feeding these spiral shutes, so as to eliminate the large circular opening which would be required if the chute passed through the floor.

The full circular opening is required in the case of gravity roller spiral chutes, because of the low grade of the conveyor run; such a circular opening is shown in figure 10. Where the full circular opening in the floor is used, it is generally difficult to provide the proper fire protection, and in some states it is necessary to house the entire chute in a special fire proof well.

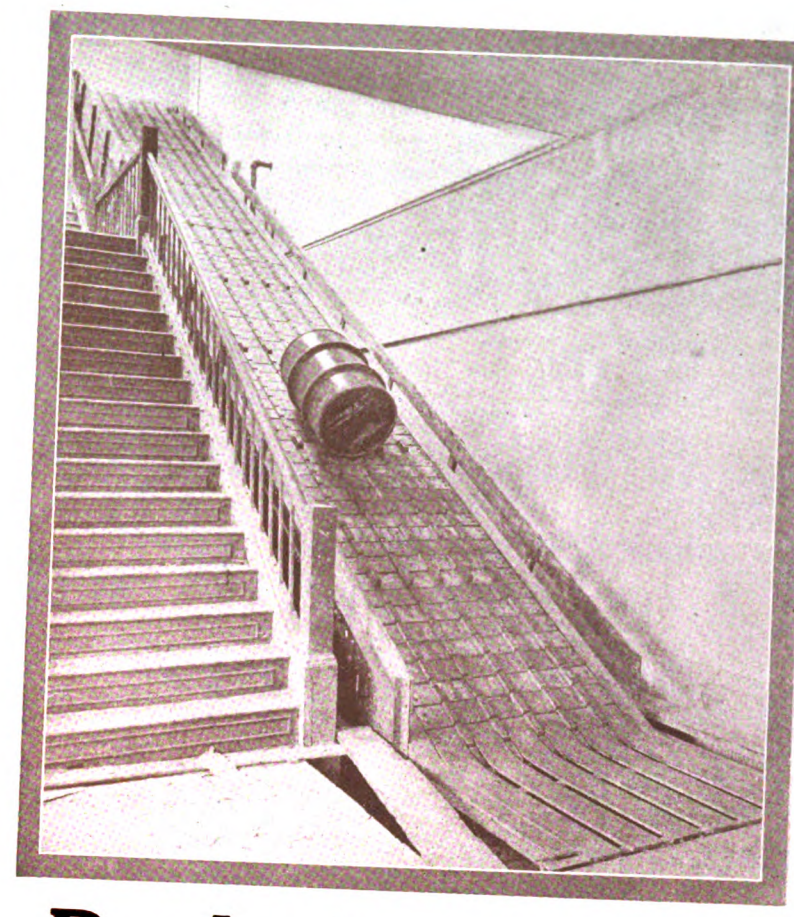
Thus we see that materials handling equipment can be used for lowering of materials between floors, whether such material is heavy, light, bulky small, non-breakable or fragile, and the same is true in the elevating of materials between floors.

Platform freight elevators are intermittent in service, as they have to be loaded, elevated or lowered, and then unloaded. For this reason, push bar elevators, arm and suspended tray elevators are installed, so that a continuous stream of material can be handled. In addition, practically all types of conveyors have been fitted with attachments to serve as elevators, as shown in figures 20, 29 and 31, and frequently such an application and installation is justified.

A typical push bar elevator installation is shown in figure 22, for handling push trucks in a textile plant. A very good combination of slat conveyor and push bar elevator is shown in figure 9, and is recommended where the load is to be carried, instead of slid up the incline.

On the elevating operations, arm elevators, suspended tray or finger elevators are more highly recommended than the use of some type of conveyor, fitted with attachments. With this class of equipment, the load is carried, and vertical lifts can be obtained.

A typical installation, showing a suspended tray elevator handling boxes is shown in



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figure 6. This elevator is also designed to handle barrels or sacks.

Figure 27 shows a suspended tray elevator for handling small packages. These packages are placed on a wooden tray, so they can be transported on a gravity conveyor. This elevator has an automatic feeding device, and is a good example of the proper way to safeguard such equipment, when it is placed in the center of a room.

Figure 27 shows a suspended tray elevator handling rolls of paper. Figure 28 shows the same type of elevator, handling trays of dishes in a restaurant. The power driven positive discharge for carrying the trays on to the table is a necessary feature in this installation. If trays were not definitely discharged, there would be considerable breakage.

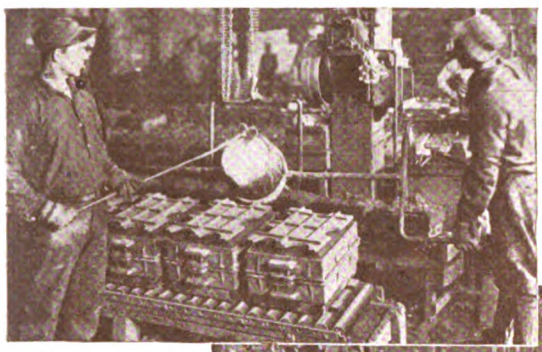
These illustrations show how the same principle of elevating can be applied to practically any industry, and for handling any size, weight, or type of package.

Simple arm elevators will receive the load only on the upper moving side of the elevator, and discharge it only over the head shaft. This is shown in figure 5. This type of elevator is recommended only for short lifts between pre-determined points of feed and discharge. Special arms have been designed for use on this type of elevator, which permits the load to be discharged on the vertical lift at various floors.

The reason for installing materials handling equipment is, as stated in previous articles, the overcoming of the present labor shortage, and the releasing of men for more productive work. If it is decided to install this equipment, the only question to decide is what type of machinery is best adapted for the work and at the same time offers the best chance of showing economies. At this point, the plant executive must use business judgment as to what constitutes an economy. In order for a machine to prove its suitability, it must not only show a profit in operation while it is busy, but the nature of the installation should be such that the machines can be kept busy a sufficient amount of time to pay a comfortable profit, and also to pay for its first, or installation costs, within a reasonable time, say from six months to a year.

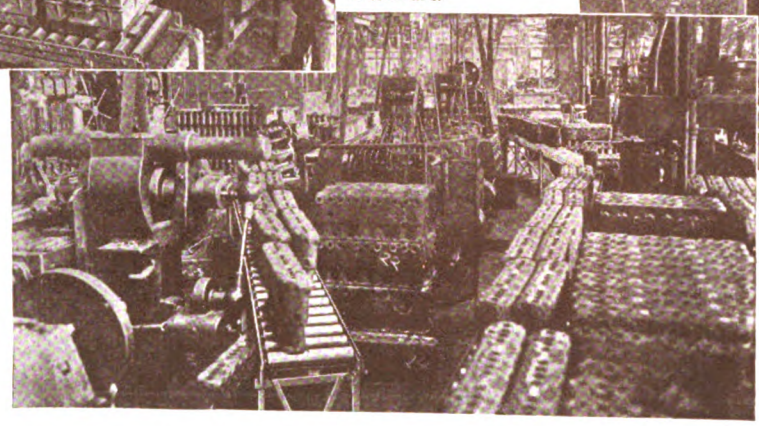
The illustrations show only the main or general types of equipment, and many installations have been made using the same principles of operation, but different design in machine construction. This would really come under the heading of special equipment, not standardized by the materials handling manufacturers, although frequently built up of standard parts. If it is necessary to design a special conveyor, or elevator, it is not difficult to obtain estimates or to find a manufacturer willing to build

(Continued on page 53)



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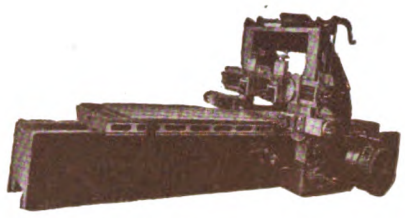
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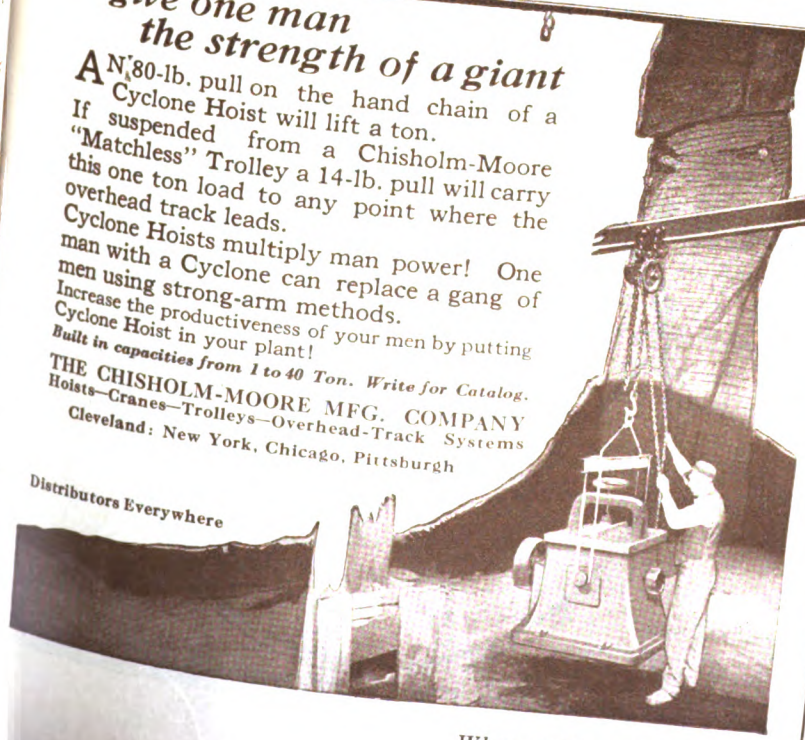
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it, although in a number offor improvements and these cases, the equipment manufac-suggestions should be given turers will offer suggestionsevery consideration.

What the Worker Thinks About Good-Will and Cooperation

BY RUSSELL J. WALDO

EVEN though there are scores of men clamoring at the gates of our factories begging for employment yet there is a shortage of good men, men who are capable of doing their work with the least possible loss. There is a labor problem as serious now as during the keenest labor shortage this country has ever faced. Keen and far sighted executives have expressed their opinion that good men are available and this is very true especially when one looks into the factories where men are employed and finds the vast number who are employed in occupations in which they are not adapted and finds in those occupations men working who are highly skilled in other occupations.

There are men who, when they gain entrance in some occupation in which they can gain some interest in their work cease to look for openings in which they are better adapted by experience and ability to fill. They are working, they are making their living and that seems to be enough for them. They are satisfied and keep moving along even though they are not doing the kind of work they are best fitted to do.

It then seems to me that the one great problem in industry today is: how shall we go about the task of directing men into the class of work they are most interested in and are best fitted by experience and ability to fill? It is a strange fact, however erroneous it may seem to many, that executives who are advertising the strongest for men have overlooked the one big opportunity they have had for the building up of their working force.

There are men calling at their offices daily asking for employment and in scores of cases they are asking for definite placement upon some particular machine or task. When a man asks for a definite place and is willing enough to come to the gates of the plant and ask for that definite place he in almost every case has sufficient experience to convince himself at least that he can hold down that job if given the opportunity. He comes having no idea that there is such a job open as he is asking for, yet is interested in that particular job.

The man who calls and asks for a definite position is usually worth more than the man who calls in answer to an advertisment calling for a man of a given qualification. It is surprising to note the difference between these two types of men and both seem to possess the same ability upon first consideration. However, closer examination will prove that there is a difference very much in favor of the man who calls when he knows there is no position open, yet hoping he may have a hearing.

There have been scores of methods tried to create closer relationship between the employer and the employee. Industrial courts have been organized, the committee system of representation has been worked out very elaborately, closed shop has been tried,



Exterior and interior views of Westinghouse Elec. & Mfg. Co. plant, East Springfield, Mass. Equipped with 10 Skinner Bros. (Baetz Patent) Heaters.

If you are still using old-time heating apparatus that doesn't give you the service you should get, it is time now to investigate this new and more effective system. Its performance is amazing — it acts as a heater, ventilator and air conditioner combined and can be used summer and winter with equal advantage.

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2nd — A simple arrangement permits the unit to be used either as a heater or ventilator or as a combination heater and ventilator. It is useful both winter and summer and therefore affords real economy.

3rd — It is so effective that it needs to be operated only a few hours morning and afternoon to keep a building comfortably warm. Utilizes live or exhaust steam at any pressure. Simple to install and operate.

4th — It is sold on a definite guarantee basis.

The Skinner Bros. (Baetz Patent) Heater is so superior to old unsatisfactory types that it has been adopted by many industrial users in the U. S., such as Ford Motor Co., Quick Meal Stove & Range Co., Federal Foundry, Castanea Paper Co., St. Louis Independent Packing Co., and others.

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Baetz Patent HEATING SYSTEM

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bonus systems have been worked out and after all these have been said and done unless the worker's personal ability has been the deciding factor in the plan there has surely been a failure.

Employees everywhere are seeking to be given an opportunity to work as men and not machines. They seek that opportunity to express their real selves and not be handled as so many machines. They have minds of their own and they seek recognition of their ability.

Scores of men in every plant have good ideas which could be used to the advantage of that company if they would go about gathering that information for the benefit of the organization. So many times employees have given the foreman an idea for the improvement of the department and the foreman has taken the credit for the improvement. Men who are seeking to be promoted do not like this method. They are working to be promoted themselves and not to let some other worker profit by their special ability.

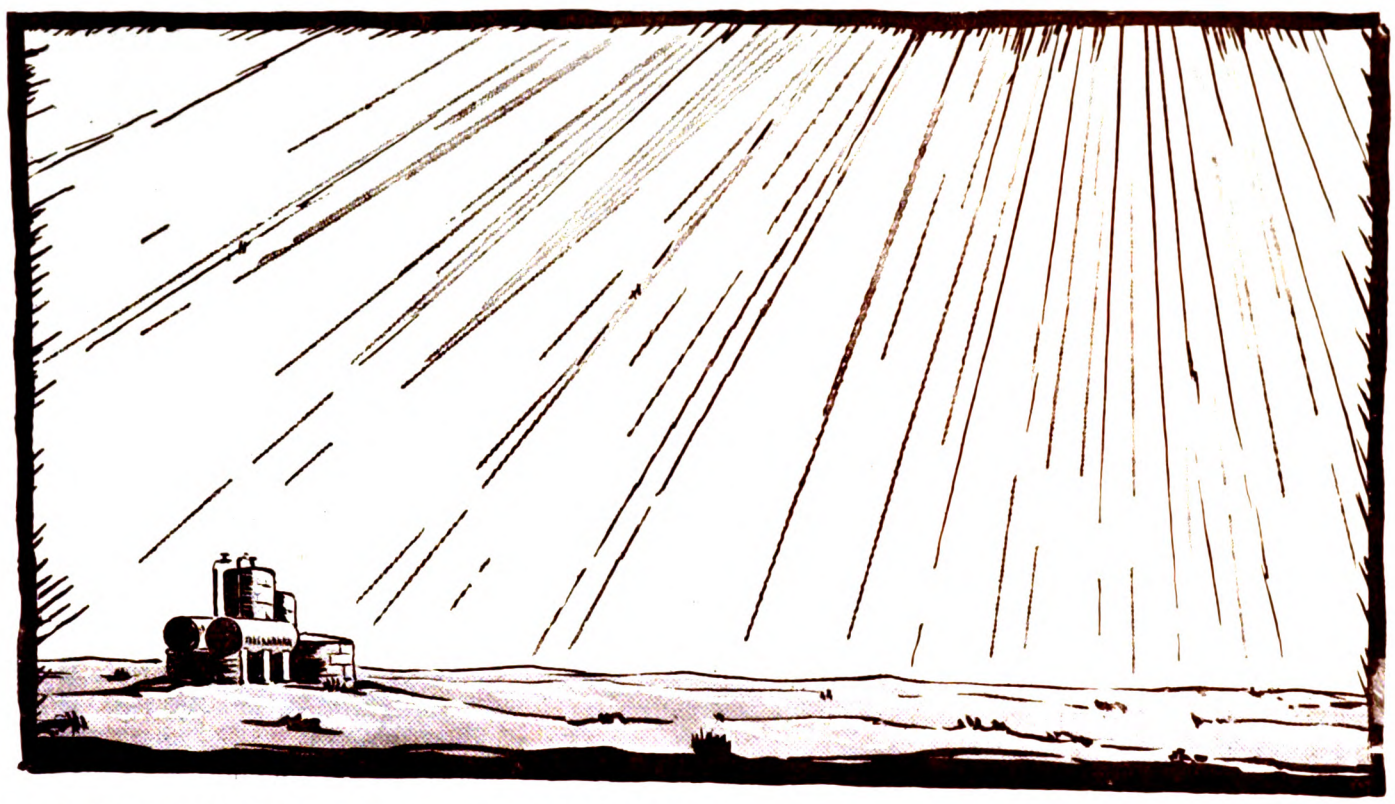
There were some enormous lessons learned during the last war. Every man, woman and child was organized to save time, effort, and material for the saving of American ideals. There was a patriotic responsibility existing then that seemed to pass out of existance directly after the war. What this country needs is wholehearted coöperation between both employer and employee. There seems to be strife on the part of both employers and employees. Each wants the best of the bargain. Which deserves the biggest share is not a question unanswered but one which has long been answered.

Both employer and employee should have income sufficient for comfortable living without requiring constant planning as to how both ends can be made to meet. The remaining profit then should go to the employer for providing the employment and as extra incentive for the responsibility which is attendant upon any enterprise.

Nearly every day we hear some one come forward with a well dressed plan for the creation of closer coöperation. When that plan is gone into thoroughly we will find that it is nothing more than the plan of some radical who is seeking to force the entrance of the organized labor or the swindling of the employer out of a large sum of money.

It is not necessary to bring in some exceedingly high priced engineer for the working out of some new plan. The writer has found it to be good policy to avoid all engineers who ask such exceedingly large rates for their service. It is true that they have spent huge sums of money to perfect their plan yet they have nothing that some keen and far sighted employee could not dig out and put into use at a much smaller figure than would be required by the former.

The time when employers believed that "give a man exactly enough to meet his existing needs and he will remain with you longer" has passed. Employers everywhere are beginning to realize that if they would have the best of workmen they must pay them living wages to encourage them to stay, not the existing wage to force them to stay. Men who are forced to stay do the least possible work to get by. Men who are pro-



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On your next Tank requirement, put it up to Lancaster.

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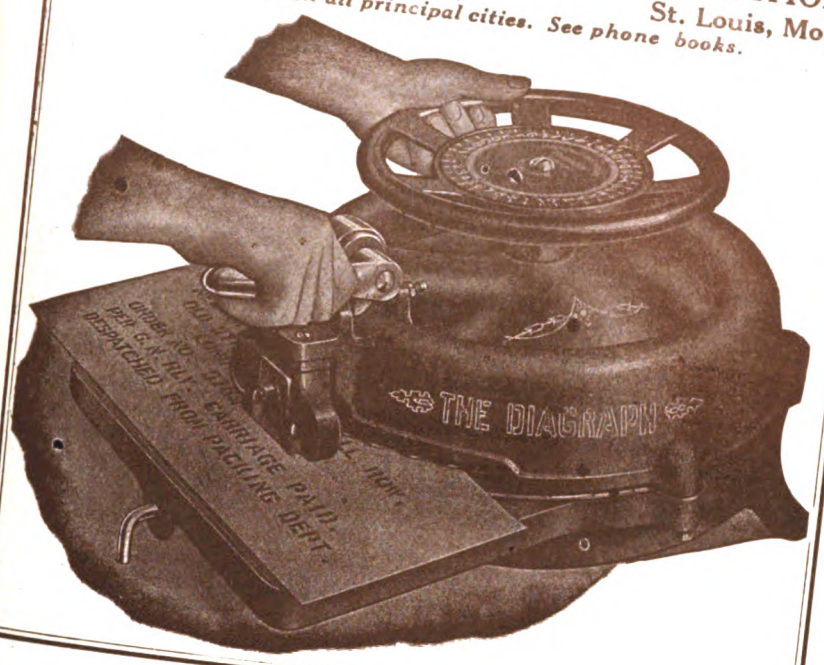
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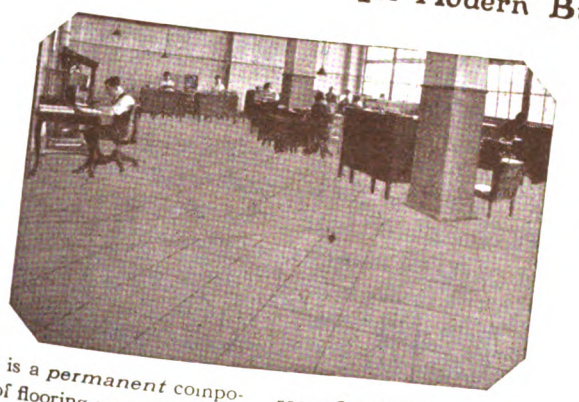
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vided a living wage and proper environment to work in, work to the interest of the company rather than their own lazy interests.

It is true that employees have been humored for the past few years and have been spoiled like the little boys often are. However, this can not be cut off completely at once without thoroughly and completely educating the workers as to the reasons, and educating them in the better management of their affairs. This can all be done with no increase in the personnel of the organization or the suffering of the workers or their families. The worker is mightily interested in the welfare of his family and he must see how he can provide for them. If his wages must be reduced he must see where he is coming out even, at least until prices come down. Prices have not come down to a very large degree, yet they have come down some and must come down more.

There are some measures of buying for workers in large quantities which have attained remarkable success and have been fully appreciated by the workers themselves. It is such as these which help hold the workers together at no added cost to the employer.

Coöperation must be obtained from the office boy to the superintendent and when obtained must be held firmly if ever industry expects to come out of the present chaotic state in which it now is.

THERE is no definite size to which coal must be ground for use in powdered coal burning plants, although it is recommended, generally, that 95 per cent of the pulverized coal should pass through a sieve with 100 meshes to the inch and 80 to 85 per cent through a sieve with 200 meshes to the inch, states John Blizard, fuel engineer of the Department of the Interior in Bulletin 217, just issued by the Bureau of Mines. It has been found possible to operate some furnaces with coaser coal, and found necessary for firing open-hearth furnaces to grind the coad more finely. The more finely the coal is ground the more rapidly will it burn, and the more readily will the smaller ash particles pass off with the gas.

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Zig-zag, like this?

or

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Although you may *think* you are getting uniform temperatures in important processes involving the use of heat, you would probably be amazed if you could see the wide fluctuations that result from so-called hand "regulation."

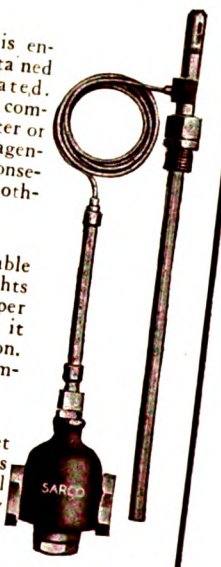
The zig-zagging of temperature usually means waste of ingredients, spoiling the finished product, or lowering of quality of the goods which means undermining your reputation. These conditions are permanently corrected by using the

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No human hand can begin to compete with the Sarco. Responding instantly to the slightest temperature changes, it automatically admits or shuts off the steam, preventing excessive variations. Once set for a given temperature, *it maintains that temperature.*

The Sarco is entirely self-contained and self-operated. No electricity, compressed air, water or other outside agencies required, consequently it costs nothing to operate.

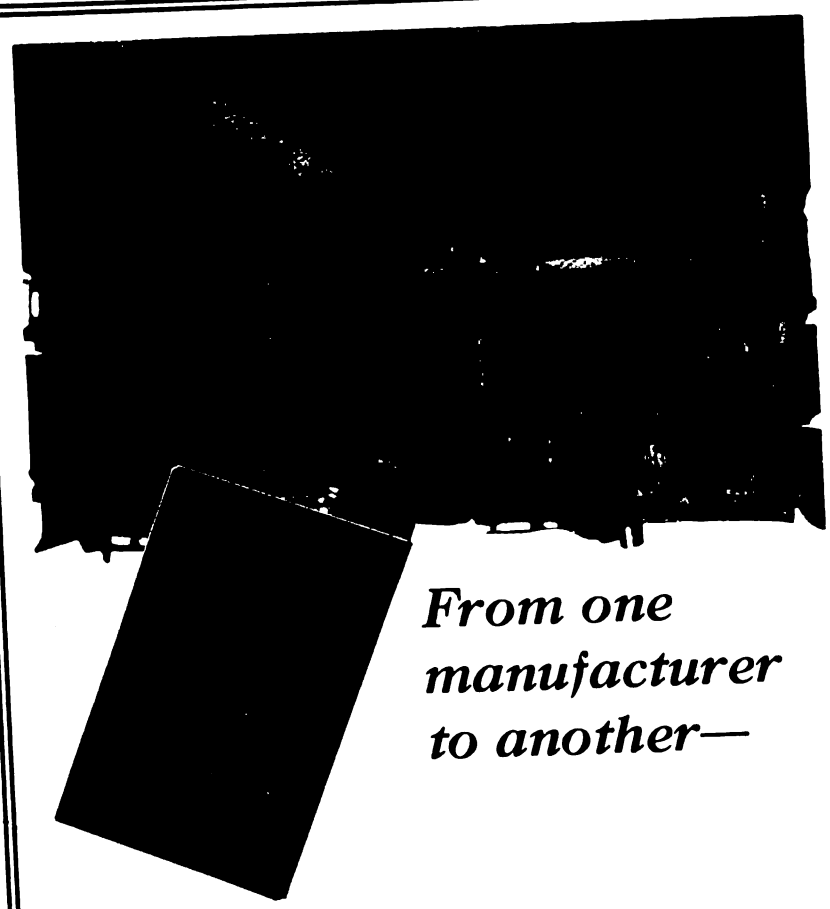
Has no perishable parts. No weights or levers to tamper with and throw it out of calibration. Not affected by temperature of room.



Write for Booklet R-77 and particulars about our free trial offer. You can try it before you buy it.

SARCO CO., Inc.
236 Broadway, New York City
Buffalo Chicago Cleveland Detroit Philadelpia
Peacock Bros., Ltd. Montreal

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From one manufacturer to another—

There is a human tendency to take our own advice first and the other fellow's afterward—and we confess that in our own plant here in Kalamazoo this tendency has more than once been the reason for passing up equipment and methods which, when they were finally forced on us, seemed indispensable.

One thing, however, has forcibly brought home to us the error of our ways—experience with *other* manufacturers who failed to see the possibilities of our equipment—the great saving of air conveyors for handling hundreds of raw materials.

And it was because we realized from our own experience the tendency for most organizations to become too self-centered, and as a result overlook real labor and money saving opportunities, that we compiled a boiled down book illustrating a number of the highly profitable uses of moving air. It shows clearly the more common uses—and to the alert executive it will suggest many other similar applications.

We know that hundreds of plants can profit by utilizing the great power of moving air—but we are not suprised, knowing that human tendency, that they are skeptical about it. We merely ask that men responsible for reducing and keeping down operating cost give this book an open-minded hearing. Surely any good executive is willing to do that!

Clarage Kalamazoo

CLARAGE

FANS~BLOWERS~EXHAUSTERS

KALAMAZOO

Clarage Fans are built in types and sizes for every service.

Assembling Fordson Tractors "On the Move"

(*Continued from page 26*)

of the final assembly lines, which are in reality the keys or indices to production.

On the first motor assembly line, the crankshaft and camshaft are fitted. After the bearing caps have been tightened down on the camshafts they stop at the burning-in machines where from fifteen to twenty seconds of running in produces a finished bearing job said to be even better than that which could be secured by scraping.

With this work completed, the cylinder is returned to the second line where the pistons, connecting rods, valves, springs, magneto, etc., are assembled. A minor conveyor line shown in one of our pictures is used for the preparation of the piston unit assembly which comprises pistons, rods, rings and pins.

The completed motor blocks are again run in on a battery of motor-operated machines to assure smooth running and to indicate the existence of friction prior to the final assembly of the tractor.

While work on the motors has been progressing, similar progress has been made on the rear axles and transmission housings. These are assembled step by step by gangs of men stationed at either side of the assembly lines, each man having some specific operation to perform on each unit as it comes to him. Most of these operations have been split into their simplest possible components, so that skill is acquired in performing them in the least possible time. Naturally some operations require more skill than others and thus on the more difficult ones are found the more experienced and higher paid operators. Some of these men develop an almost uncanny sense of touch or sight so that they can detect irregularities and dimensions that would usually be made apparent only at the careful micrometer measurement. One of these operators, for example, has specialized for a number of years in inspecting crankshaft bearings after the burning-in process and in applying the necessary laminated shims. This operator can tell after one glance at a bearing and its cap the exact number of shims required to set the bearing to its running condition.

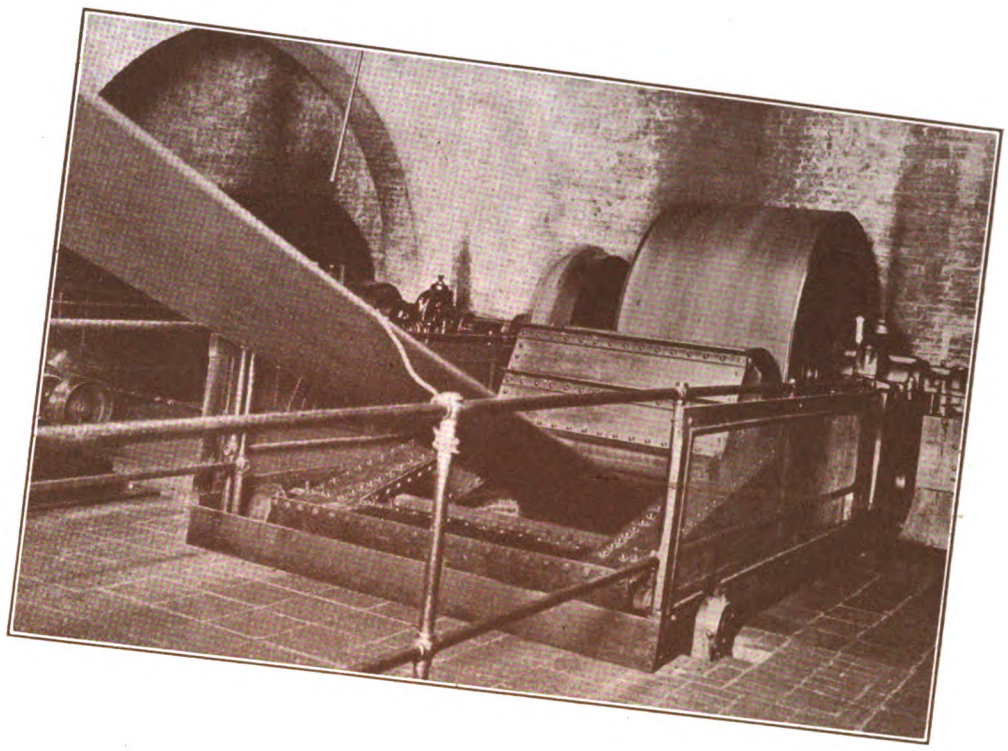
There has been a good deal said about the monotony of such highly specialized work as that of these assembly lines. There are some operators at River Rouge who like to change from one job to another; there are others who are exactly opposite in this respect. After an operator has spent a reasonable amount of time at any job in the line if he desires a change for the sake of variety it is usually arranged. Various operations of course require different physical characteristics, some strength, some quickness, etc. In the assignment of new men to the lines these requirements are very carefully kept in mind.

The most fascinating part of the assembly line is that where the completely assembled tractors descend from the conveyor rail. At the present rate of production they come off at the rate of one every one and two-fifths minutes. While the last operations in assembly are being performed the radiator has been filled, and "gas" oil deposited in the tanks. When each tractor comes off the line, therefore, it is ready to run. A tester jumps into the driver's seat and adjusts the spark and throttle control, while at the same time the "starter"—another operator—has brought into position in front of the tractor a swinging, electrical cranking arm which grasps the crankshaft extension and at press of a button spins the motor. Almost invariably they start after the first revolution or two. In driving them under their own power to the paint line the testers are able to determine if any adjustments are required and to make them.

Painting is also performed "on the move" with specialists, each assigned to cover a certain area or part. Two colors are used: red for the wheels and gray for the remaining parts of the tractor.

(*Continued on page 58*)

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Point Number One—"Arc of Contact"

SEVERAL FACTORS must be taken into consideration in planning a belt drive to insure its successful operation. The most important of these is the *arc of contact* between the belt and pulleys.

An arc of contact sufficient to transmit the load may be obtained by two methods:

Natural—by the use of long pulley centers and slack belts, involving a large amount of floor space

Artificial—by the use of tension idlers or idlers of the flexible, resilient type when acting as belt wrapping devices, such as

THE LENIX DRIVE

A lack of floor space may prevent the use of the natural means. Where the necessary floor space *is* available it is expensive to use it for the purpose of giving long pulley centers to a belt drive. The disadvantages of the tension idler offset the benefit obtained through the slightly increased arc of contact it creates.

For eighteen years we have been building the "belt wrapping" LENIX DRIVE and are the pioneer manufacturers in this country of this type of drive.

At the plant of a brick manufacturer in New Jersey, a 1400 HP Corliss engine could not deliver more than 900 HP because, through lack of sufficient arc of contact, the belt would not hold on the lineshaft pulley when the load was raised about 900 HP.

A Lenix drive was installed and, as illustrated, is wrapping the 50", three-ply belt around practically three-fourths of the circumference of the lineshaft pulley, and the engine is now delivering its full capacity.

Booklet "Saving Slippage and Space" tells how it is done.

How belt tension is reduced, rather than increased, by the Lenix will be told next month under "Point Number Two."

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

F. L. SMIDTH & CO.
ENGINEERS
50 Church Street **New York, N. Y.**

THE LENIX DRIVE

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ALLOY STEEL



Save Time and Labor In Handling Materials

Not to use a modern system of conveying and handling materials is a great waste. Whenever anything is placed on the floor it has to be picked up again, which costs money. Instead, it should be placed on a Truscon platform and then it is all ready to be moved without further handling. Either hand, or power-lift trucks may be used.

Standard Size of Truscon Platforms

Clear heights (inside): 6½", 7½", 9½", 10½", 11½", 12".
Over-all widths (outside): 24", 30", 36", 42", 48".
Clear widths (inside): 2¼" less than over-all widths.
Lengths: 24", 30", 36", 42", 48", 54", 60", 66", 72".
Other sizes to meet special requirements.
Indicate quantity, length, width, clearance height and width of truck.
Attached stakeholders, handles, etc., provided if ordered. Boxes, skeleton frames, end pieces, etc., also furnished.

For small objects or loose materials, Truscon Steel Boxes are used with platforms. We furnish practically any kind or size of steel box for handling materials, Truscon Steel Boxes are conveyors, cranes, etc.

Truscon Steel Boxes Skeleton Boxes for Steel Platforms

Furnished in 12", 18" and 24" depths. Either welded securely to the platform or equipped with steel stakes which slide into ribs of platform. Boxes may be stacked to any height.

Steel boxes of all kinds and sizes for handling materials and products. Tell us your requirements and your method of conveying. We will furnish you practical suggestions, estimates, etc.

Truscon Steel Company
YOUNGSTOWN, OHIO
Sales Offices in Principal Cities

(Continued from page 56)

The supply of paint is contained in tanks which are built along the sides of the painting line over which the tractors are drawn by chain conveyors.

Descending from the paint line the completed tractors are driven to the parking spaces where they are allowed to dry and thence to the box cars in which they are shipped. Thus ends a most interesting process of integrated manufacture as examplified at River Rouge.

FIREMAN JOE

By James T. Beard, 2nd

There is Fireman Joe; he's the busiest man
For he watches his gages and throttles his fan
And he keeps all the heat of the coal that he can
From the stack.

And there's B. T. U. Cole and C. O. Toogass
They are friends of Old Joe, but they sure have the brass
For they asked the Old Man to give them a pass
To the stack.

Now C. O. Toogass is a worthy old soul
He is not full of mischief like B. T. U. Cole
So they gave him a pass and he leisurely stole
Up the stack.

Then B. T. U. Cole got pretty darn sore
He fussed and he argued; he cussed and he swore
And one day he jumped with a terrible roar
Toward the stack.

But Pyrometer Bill was awake at his post
And saw him go by like a vanishing ghost
And as he sped on he flung back a boast
From the stack.

Then Pyrometer Bill got busy right quick
And telegraphed Joe about the mean trick
How B. T. U. Cole tried to climb up the brick
In the stack.

Then Fireman Joe shut the damper a crack.
"Now I can't let you out to the big roomy stack.
For, once you get out, I can't get you back
From the stack,"

Said Fireman Joe; he's the busiest man
As he watches his gages and throttles the fan
For he keeps all the heat of the coal that he can
From the stack.

THE SEAT OF
Production



No. FS-22, Patented.
Adjustable Legs and Back-Rest

The value of "Royal-Chicago" Chairs is not represented by the cost of so much steel, wood, and labor, but by the increase in efficiency and loyalty for which they are responsible.

Royal Metal Mfg. Co. 2312-14 S. Western Ave., Chicago, Ill.

"Royal-Chicago" PRODUCTS
THE CORRECT INDUSTRIAL SEATING

Steam Generation at 3200 pounds!

Will wonders never cease—

This, from England, is the latest steam pressure proposed and a station will be built to operate at this pressure. First 600 lbs. sounded feasible, 900 lbs. doubtful until 1200 lbs. was put into operation and now 1500 and 3200 lbs. are proposed. How the steam world do move!

As one engineer put it, "Anything to get more out of a pound of coal and the sooner the better."

These steam pressures may be just in the offing but the present problem of the practical steam engineer is to do everything possible to assure himself that coal is not being wasted unnecessarily.

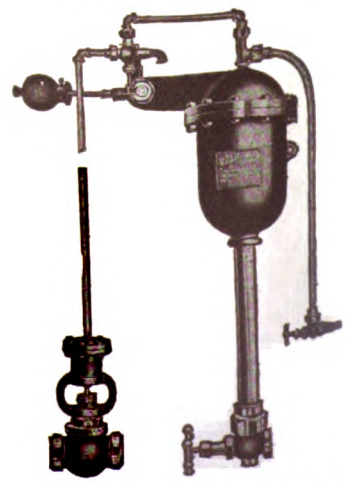
And many companies have found that they can do this by installing Vigilant Feed Water Regulators which keep the water level constantly within one-quarter inch of center gauge regardless of load or method of firing.

For the highest overall operating economies — you need a steady water level at all loads; you need a Vigilant Feed Water Regulator. The first step is to find out, without obligation on your part, what the Vigilant will do for you. The second step is to

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VIGILANT Feed Water Regulator



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The Executive's Greeting to Callers

By Helen Hysell

TOO often, the business executive who believes implicitly in the indelible quality of first impressions is concerned mainly with his own first impressions of the caller. The "approach" as he sees it, is onesided—not because he thinks only of himself but because he has not thought at all.

If one may judge by the elevator employees, reception clerks and office boys one meets between the street entrance and the door of the private office, the majority of executives are an extremely short-sighted group of men. And, unfortunately for all concerned, the impression the caller makes upon the executive is good or bad, according to the impression the executive has made upon the caller on that long and frequently embarrassing trip to the private office.

He sits at his desk, this impressionable executive, waiting to be impressed by the caller whose name the reception clerk did not repeat correctly over the telephone. His eyes are on the door as he wonders what Smith from Smytheton wants; how hard it will be to get rid of him; whether he'll offer a cigar; talk about the weather; wear spats; or try to sell insurance. And his facial expression is caught and remembered by Mr. Smythe from Smithfield who has come as a representative of a concern with which the executive has had much correspondence. Mr. Smythe is already annoyed because the beautiful—but dumb—reception clerk has mixed his name with the name of his town and omitted entirely to state the business on which he has come.

This annoyance is reflected in the stiff smile with which he greets the executive whom he wished to approach with an open mind. It shows in the tone of his voice, in the way he crosses the room and in the half-hearted grip of his hand. He has approached the executive with an open mind and, whether he wills it or not, Mr. Smythe from Smithfield is disappointed and his mind closes automatically. He may marshal his faculties quickly and dispatch his business without preamble. Or he may take up half an hour of the executive's time before he recovers his poise. But his mind remains closed throughout the interview and also throughout future interviews, if any.

The executive is conscious only of the unfavorable impression the caller has made upon him. He has granted an audience and put himself into a receptive mood. True, he was a bit doubtful as to his caller's name and business and, naturally, curious as to what was coming. But that wasn't his fault. He hadn't known it was Smythe and not Smith but he had made an effort to be gracious the moment he found out. He was particularly anxious to be pleasant to the fellow because of a favor he planned to ask of Smythe's firm. Smythe hadn't given him a chance to be pleasant. He was grouchy like most of the other chaps who came into the office.

From this point the executive is likely to wonder why all this talk about the "psychology of the approach" hasn't had any effect. He reflects upon the oddity that scarcely one person in fifty really acquires a pleasing approach. If he is a purchasing agent and his callers are salesmen, this puzzled executive will also wonder how a fellow "with a perpetual grouch" ever sells anybody anything and he will be frowning at the door through which the next salesman must enter, even as he wonders.

If he is one of those purchasing agents who waited long hours in the outer offices of sales concerns during the hectic catch-as-catch-can years of war-time sellers' market, he

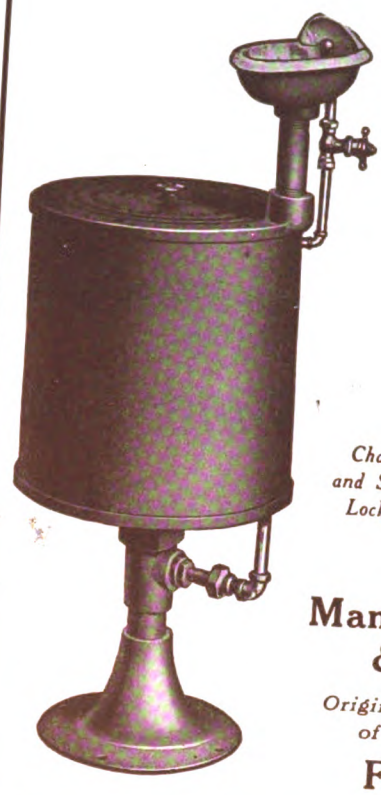
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may remember the pretty little girl who snubbed him so unmercifully one day back in 1920; or the superior office boy who condescended to tell him that "the boss's got no time for buyers or pedlers"; or the sub-assistant something or other who stood snobbishly between him and the official he had traveled two hundred miles to see. If he has fought desperately to keep his temper in the face of irritating rudenesses, neglect and indifference on the part of various minor employees while trying to get an audience with the correct representative of an essential wartime source of supply and remembers the failure of that attempt, it may occur to him to wonder "Why the grouch."

It may even occur to him to swallow his pride at the first indication of pettishness or stiffness on the part of salesmen and proceed to take a look at conditions outside his door. He should know, without being told, that his "approach" is wrong but the realization of this fact may not come into his conscious mind immediately unless he forces himself to ask "why" the change in the salesman's "approach" and to ask this question of the salesman himself.

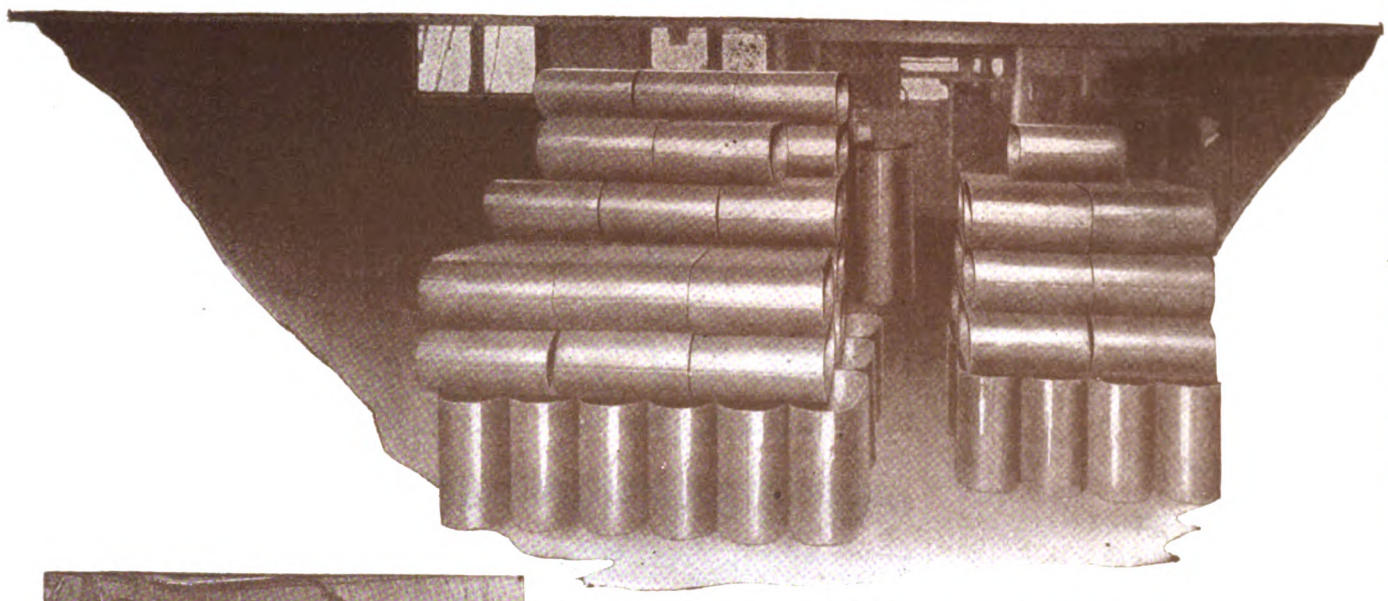
This much discussed "approach" has been and still is both under and over-rated in its importance to modern business relations. In one way or another it has come to be applied almost exclusively to salesmanship. It is the salesman who is assumed to depend upon making a good first impression, a pleasing approach. And it is his personality that has come to constitute his approach in the majority of minds—including his own. And it is in salesmanship that the importance of the "approach" has been so much over-rated.

There can be no doubt that, all other things being equal, the salesman stands or falls by means of his personality. But all other things are seldom equal. And, in the final analysis, it isn't the so-called personal impression that counts so much as it is the intangible, beyond-self atmosphere of efficiency, honesty and desire to be of real service.

The average purchasing agent has far too many different brands of different materials to consider for him to know each one as completely as the salesman knows it—or should know it. And it isn't the wave of personal liking so much as it is the undercurrent of good will and friendly feeli aroused by the salesman that makes the purchasing agent stop, look and listen. It is not the manner of approach that the purchasing agent buys. It is the material. And he buys the material because the salesman has succeeded in showing him that it is what he wants. The salesman who understands that the modern purchasing agent looks upon him and his clan as advisors rather than pests and succeeds in "putting over" his desire to give honest advice and council whether he gets an order or not, has acquired the best possible "approach" regardless of the purchasing agent's personal feeling for that salesman's smile, his hand clasp or his brand of cigars.

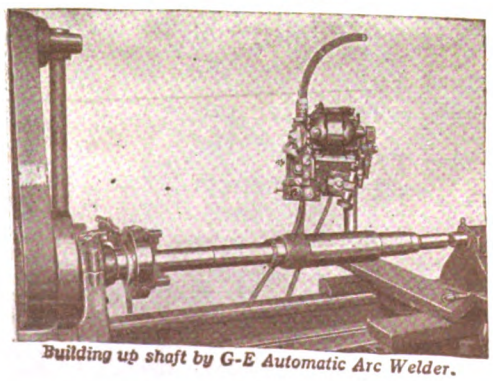
A natural, man to man manner is infinitely preferable to the mechanical pleasantness that creaks of "stage busi-

Where Speed Shows Better Results





Straight seam welding of tanks by G-E Automatic Arc Welder.



Building up shaft by G-E Automatic Arc Welder.

Automatic Arc Welding

The above picture shows 50 tanks welded by a G-E Automatic Arc Welder in a half day, as compared to 21 tanks welded by the hand method in a full day. The metal welded is 1/8" thick by 24" long.

Through this automatic application of the electric arc, a steadiness of the electrical conditions in the arc is obtained and maintained, resulting in a uniform and high quality of weld—and higher speed. Higher welding speeds produce lower welding costs.

The principal field for the G-E Automatic Arc Welder is the production, by welding, of duplicate objects in considerable quantities.

Its greatest use is for straight line seam, which is the simplest form of weld—but it also does efficient welding of circular seams, and in building up processes on metal.

G-E welding engineers will cooperate with you in making suitable applications of the Automatic Arc Welder to processes of production in your plant. Ask them.

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ness." If this manner is pleasing, so much the better. We all enjoy meeting likeable people. But we don't like sunshine filtered through dirty windows and that is what the artificial personality amounts to in many cases.

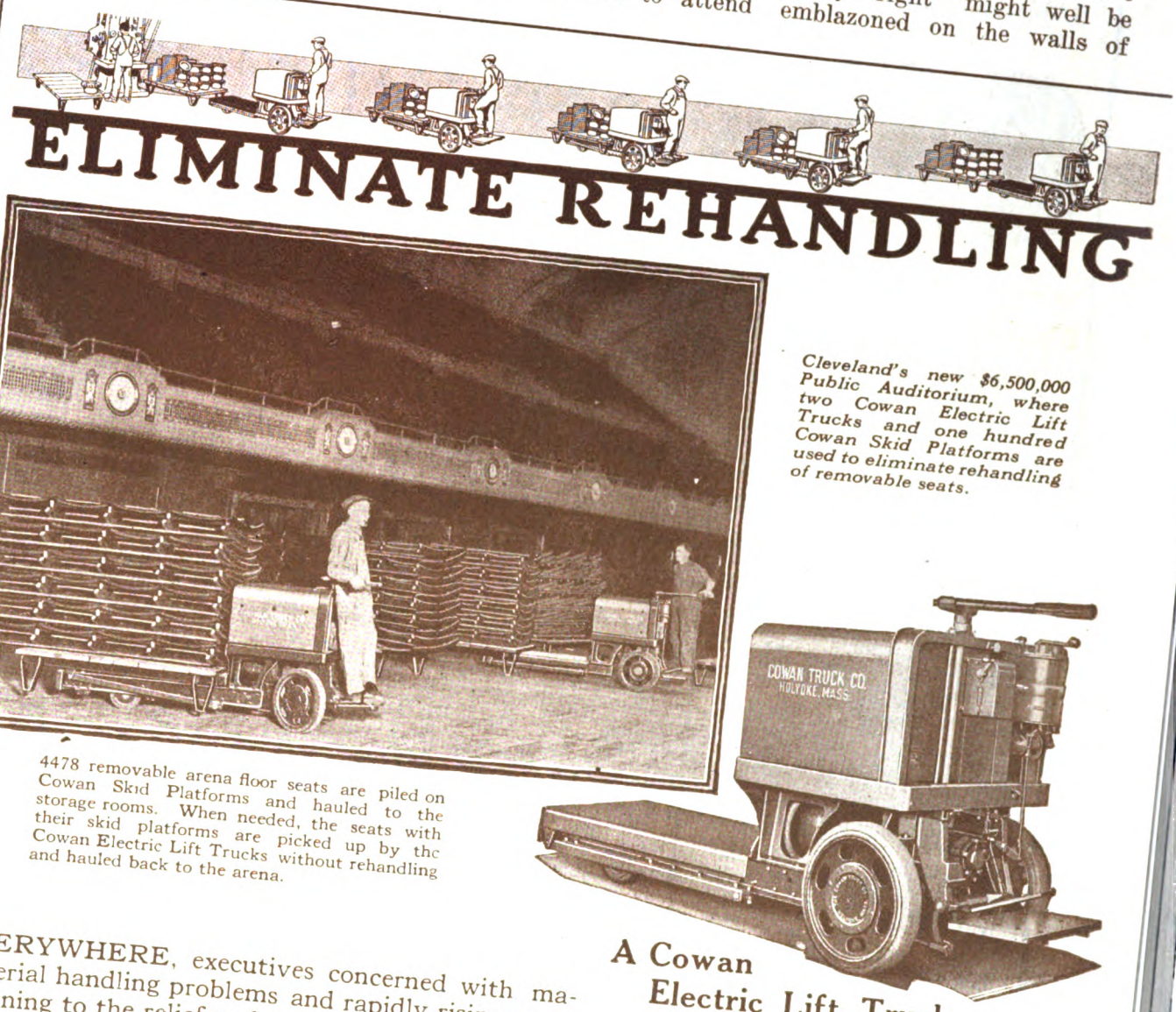
An artificial personality that makes a pleasing impression upon one purchasing agent may have the opposite effect upon another. And yet, the one who is pleased is no more likely to buy than the other unless the salesman has so presented his facts that his product "goes over." It is frequently difficult to tell where the artificiality ends and the honest statement of facts begins, and purchasing agents are notorious for their habit of "playing safe." Trained judges of men as well as of markets and materials, they will lend an ear to naturalness whether it is markedly pleasing or not and they will believe, without question, statements that would be laughed at if the salesman's manner of approach were of the artificial variety.

The approach, as it pertains to the personal charm radiated by the salesman has been, and still is, much over-rated. As it pertains to the simple courtesies extended to the caller by the employees who stand between the caller and the man he wishes to see, the approach is, and in too many cases always will be, much underrated. Even the unpleasant experience of finding himself in the other man's place— an experience through which every executive has passed at least once and the majority of them, many times—has not hammered home the truism that there are two sides to every question. The executive continues to sit behind his desk and to be impressed without once wondering if that thing called "approach" is printed on both sides of the ticket.

In some instances, the executive approach begins with the outside door. Not so long ago, an important deal fell through because an elevator starter allowed a caller to get into an express elevator and the operator, obeying orders to the letter, refused to stop at the desired floor. The caller was himself an executive of quick temper and high-handed methods. He objected to being carried to the top of the elevator shaft and back again to the bottom and he said so in a manner that invited insolence from the girl elevator operator and a curt denial of error from the starter who, knowing where the caller wished to go, had allowed him to get into the wrong car. The bad impression so created sent the irate caller hurrying back to his own office where he dictated a letter that closed, for all time, the channel of communication between the two concerns.

But did it occur to the executive who received the letter to investigate the charges made against his "approach"? It did not. The elevator starter was not cautioned to attend more carefully to his job. The operator was not scolded for her insolence nor drilled in common courtesy. And the executive assumed an air of injured innocence whenever the quick tempered caller was mentioned in his presence.

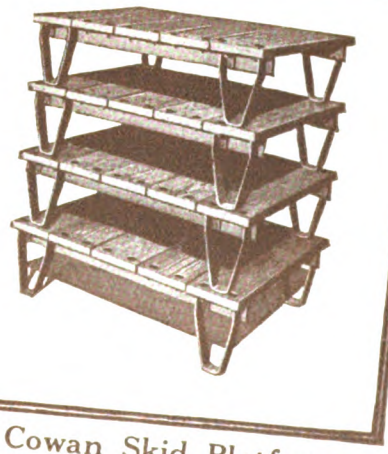
The slogan "our callers are always right" might well be emblazoned on the walls of



Cleveland's new $6,500,000 Public Auditorium, where two Cowan Electric Lift Trucks and one hundred Cowan Skid Platforms are used to eliminate rehandling of removable seats.

4478 removable arena floor seats are piled on Cowan Skid Platforms and hauled to the storage rooms. When needed, the seats with their skid platforms are picked up by the Cowan Electric Lift Trucks without rehandling and hauled back to the arena.

A Cowan Electric Lift Truck



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EVERYWHERE, executives concerned with material handling problems and rapidly rising costs are turning to the relief and economies offered by the Cowan Electric Lift Truck and Skid System.

Through this efficient Cowan System for eliminating rehandling of material, a prominent Pennsylvania manufacturer has released twenty-two men for other work and effected savings due to quicker delivery and increased "turnover."

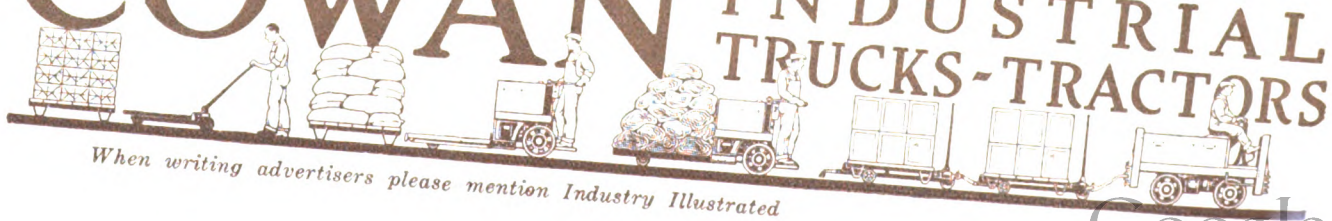
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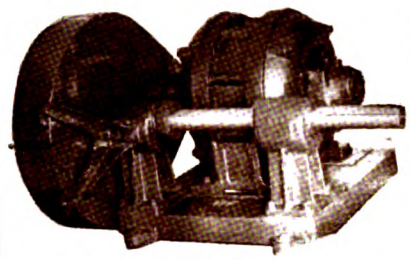
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specify a

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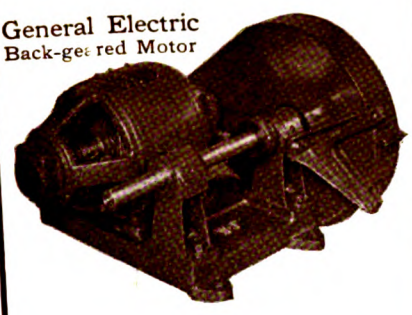
Reduction Gear Drive



ALLIS-CHALMERS
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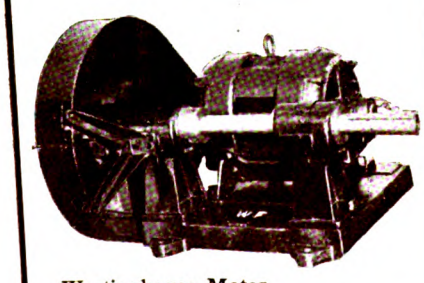
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Back-geared Motor



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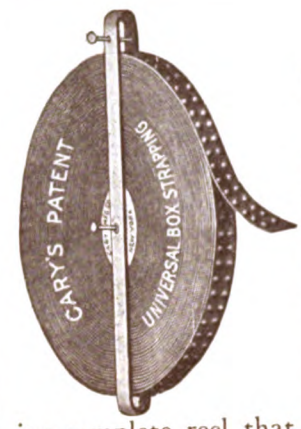
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ENGINEERING COMPANY
PATERSON, N.J.

every office just as "our customers are always right" is fixed in the minds of many organizations that depend upon satisfied customers for business success. Tactless handling of callers reflects upon all departments of business management. A "no admittance" sign upon the factory door is usually accompanied by some indication as to where the office may be found and does not reflect upon the management. But a "no admittance" expression upon the face of a reception clerk may easily be taken as a gauge of the executive attitude toward callers.

Practically all callers who enter the outer office are prepared to state their names and business. The majority of these callers present their cards to the clerk who receives them even before they specify the executive's name or title. Others, having discovered that the majority of reception clerks either cannot or will not read what is before their eyes, prefer to tell their names in the hope that errors in pronunciation may be avoided. A few—and the number will grow less as the standard of receiving callers is raised—refused flatly to tell anything but the name or title of the man they wish to see.

It speaks well for the optimistic temperament of business men—and especially of salesmen—that this latter number does not exceed the two preceding. The empty-headed, indifferent, frequently inaccurate and almost always preoccupied girl chosen by so many firms as a reception clerk is enough to cause the caller to abandon hope entirely. And the swaggering, self-important, insultingly condescending small boy or his older edition, the over-groomed and underbred young dandy are even worse. Too, there is the odd-jobs clerk whose duties are many and whose manner is flurried. The caller usually has to wait until this clerk finishes a task before he is noticed at all. And while he waits, he is subjected to the embarrassing fire of many pairs of eyes, eyes that are curious, eyes that are or seem to be amused and eyes that are merely weary of looking at work and rove from the clock to the caller and back again to the clock.



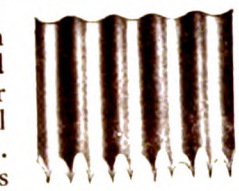
CARY'S
UNIVERSAL BOX STRAPPING
KNOWN THE WORLD OVER

as the standard for quality and strength.

This strapping is made of extra soft annealed steel of great tensile strength. Nails can be driven through it without first punching holes. The nail heads are protected, when case is moved along the floor, by the raised bosses which strengthen the edge of the strap. Every coil is equipped with our Patent Metal Hanger which makes it a complete reel that can be hung anywhere without floor space being occupied.

Made in four widths, ½, ⅝, ¾ and 1 inch. Put up in coils of 300 feet; 20 coils packed in a case.

CARY'S
SAW EDGE JOINT FASTENERS

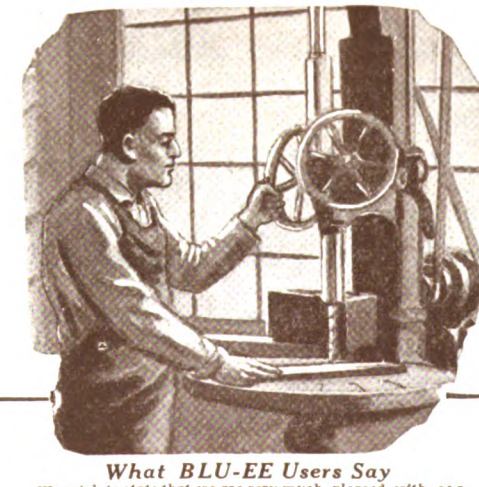


CARY'S Continuous Cutting Edge Saw Tooth Fasteners are made of the best quality Cold Rolled Strip Steel, insuring a perfect fastener that will not bend while driving. You will not find fractures between the corrugations. Special effort is made to have corrugations uniform so that they have equal drawing strength.

These fasteners are the only fasteners manufactured with a continuous cutting edge, the patents, process and machines being owned by ourselves. Made in various widths and corrugations, also in coils wound right and left. Write for samples.

CARY MANUFACTURING COMPANY
Manhattan Bridge Plaza, **Brooklyn, N. Y.**

BLU-EE
TRADE-MARK



What BLU-EE Users Say

We wish to state that we are very much pleased with our use of "BLU-EE" and find that it eliminates the glare without the necessity of placing window shades.
BROWN-LIPE-CHAPIN CO.,
Syracuse, N. Y.

We use BLU-EE on our windows to minimize the sunlight, and it answers the purpose splendidly, without keeping out the breeze; whereas, Awnings would cost considerably more and keep out the breeze.
AMERICAN SNUFF CO.,
Memphis, Tenn.

INCREASES PRODUCTION
ELIMINATES GLARE

Cooler workrooms and better light help to increase production during the hot summer months. You can protect your workrooms from the glare and heat of the hot summer's sun without expensive awnings or shades by coating your windows with BLU-EE.

BLU-EE is easily applied; simply dissolve in hot water, allow to cool and apply to the windows with a paint brush. It will not rub off but can be easily removed with warm water.

We want to prove what BLU-EE can do in your plant. Try some at our risk. Fill in the coupon below and send it in at once.

PARK CHEMICAL COMPANY
3822 Edwards Road **Cincinnati, Ohio**

Try It Out—We Run the Risk

PLEASE send me 2 packages of BLU-EE, sufficient to cover 2000 square feet of glass. It is understood that I am to use one of the packages as directed and will remit $5.00 for both if I am satisfied with BLU-EE, and if not entirely satisfied may return the other within thirty days and you will cancel this order.

Firm Name..... Position .....

Your Name..... Address .....

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It is rare, even today when every man is recognized as a potential psychologist, to find an intelligent young woman an understanding fourteen-year-old boy or a young man of the alert, I-may-be-calling-on-an-executive-sometime sort. Such an "approach" from the executive viewpoint is too expensive. Intelligence means higher salaries than the position is worth. Thousands of dollars are spent in a month for solid mahogony and plush carpets to make the executive's offices attractive but a few hundred a year is considered sufficient to employ a clerk to receive the caller who enters one of these resplendent offices. And nothing beyond a low fence and a few hard chairs is purchased for the reception room in which the caller must wait.

When, on rare occasions, a person of intelligence is found as a go-between, the caller is quick to respond with full information about himself and quite willing to wait until the executive is free to see him. Even when the reception room is a part of the main office he does not notice the battery of eyes, the rattle of adding and typewriting machines or the discomfort of the chairs. Once admitted to the private office after being courteously and intelligently received, he is more than ready to put his best foot foremost and even to overlook an incivility on the part of the executive. If he has come to register a complaint, he will be much more willing to accept apologies, explanations and adjustments if the executive's approach by way of the outer office has been pleasing.

If the caller is a salesman who has been saving an especially good proposition for some purchasing agent whose "approach" is by the way of large orders, the purchasing agent whose go-between has impressed the salesman pleasantly is likely to hear about it.

Whatever the caller's reason for calling, his manner of approaching the executive will, inevitably, be colored by the manner in which the executive has approached him. He will make a good impression or a bad one, this caller, according to the impression he has gained on his way to the private office.

The caller with the perpetual grouch or, what is more likely to be the case, the perpetually grouchy callers should make the observant executive sit up and take notice of his own doorstep. It isn't reasonable to suppose that human nature has changed just to spite the man behind the desk any more than it is reasonable to suppose that the average executive is one-tenth as unpleasant as his "approach" would lead one to believe. Yet there are a great many, executives who have never discovered the difference between private office courtesy and general office courtesy and who blame everything that happens upon the change in human nature.

The sooner the man behind the desk awakes to the importance of his "approach" and realizes that the one-sidedness —if it is one-sided—is in the line of a circle from the outer door to his desk and back again to his outer door, the sooner he will find his perpetually grouchy callers turned into perennially cheerful givers of that good will and friendly feeling which is the prime essential of business.

Made Under SKF Supervision



Ball-Bearings Help Stop Friction's Drain on the Profits of Your Plant

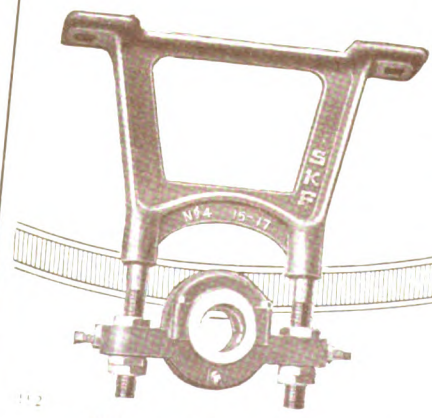
WHEREVER plain-bearing line-shaft equipment is used friction is constantly extracting its heavy toll in power loss, bearing wear and destruction, and forced idleness of both machines and men. These drains on the profits of industry are enormous, the power loss alone amounting to a considerable item.

Skayef self-aligning ball-bearing hangers prevent approximately 60 per cent of the power loss in line shafting and are not subject to heating and wear which enforce shutdowns for bearing adjustments and replacements.

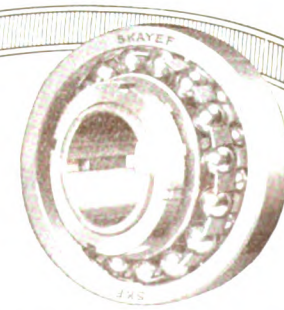
Even shaft deflections and vibration cannot affect the free running qualities of the SKF marked self-aligning ball bearings used in Skayef hangers, for this type of bearing has the exclusive inherent ability of compensating automatically for shaft mis-alignment. As friction is reduced to a minimum and as dust and grit cannot enter the sealed bearing housings, no appreciable wear of the hard steel balls and races occurs. Lubricant cannot escape from the sealed housings onto the floor, belts and goods in process of manufacture, and need be applied only at infrequent intervals.

Let our engineers co-operate in planning a changeover to ball-bearing equipment.

Stock-Carrying Agents in All Principal Cities



SKAYEF
Self-Aligning
Ball Bearing
HANGERS
(IMPROVED TYPE)



THE SKAYEF BALL BEARING COMPANY
165 Broadway New York City

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Where Do We Stand?

(*Continued from page 17*)

indeterminate peace conditions which followed make greatly more difficult the use of the ordinary trade indicators in the years intervening, but one must not forget that "prewar" again means the passage of a decade, and a decade in which science and invention have aided the processes of industry as in no preceding similar period of commercial history.

There is not only the normal increase of an enlarging population and the normal increase which follows a resumption of the constantly advancing standard of human possession which has been the feature of our national growth, but there is besides the acceleration of that standard of human possession by the very enlargement of human earning power which science and directing genius have made unmistakably effective.

Since 1913 then, these influences have come into play:

Our population has increased 14 million, with all that means of enlarged requirements.

Our annual national income has increased from 34 billion to over 50 billion dollars, with all that means of buying and investment power.

Our aggregate savings deposits have increased from 6 billion to 14 billion dollars with all that illustrates of the reward to thrift and self-denial.

Our deposits in national banks increased from six to seventeen billion dollars, with all that indicates of the accumulation of liquid capital for investment and for enterprise.

The basis of individual earnings by which these figures of aggregate wealth increase are created, and the accelerated pace at which the earnings power is secured and enlarged, can be briefly stated, thus:

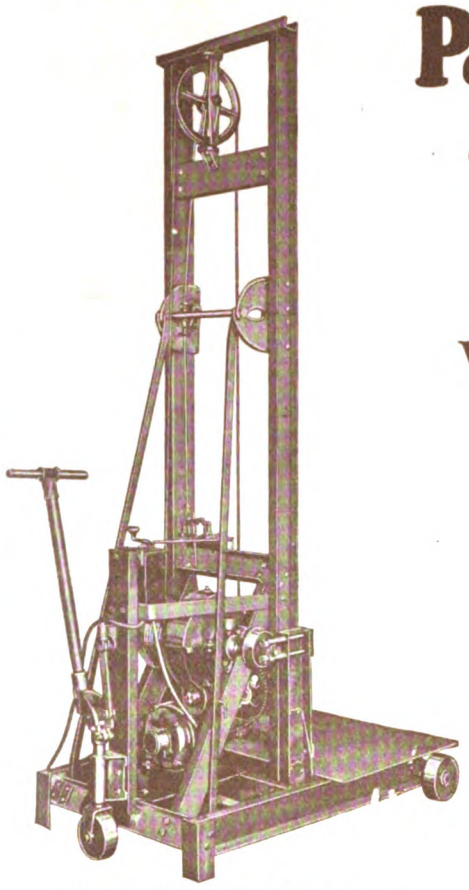
The per capita annual earnings in the United States at the following datum points were:

1850—approximately $100.
1890—approximately $200.
1920—approximately $600.

This shows that, whereas it took forty years to double the average annual earnings in this country, the succeeding thirty years trebled that earning power. These indicators show why in three hundred years of national history the United States has built a total national wealth of 300 billion dollars, with its nearest rival, the British Empire, with two thousand years of productive history, attaining a national wealth of 170 billion dollars.

If from this showing one may accept the great earning power of American initiative, energy and directing ability, then one may also fairly test the political and social system under which this material wealth has been created, by applying a test of its actual service in establishing widespread individual prosperity and content. Has this great aggregate of human possession been fairly and equitably distributed into many hands, or is it concentrated in a wealthy few? The proof of its wide distribution is written beyond question

Make Every Foot of Air Space Pay-You-Rent!



Electric Power Stacker—Type P

Heights: from 6 ft. up; Capacities: 1000 and 2000 pounds; Lifting Speed: 20 and 40 ft. per minute. Automatic safety stop top and bottom—eliminating danger of damage through negligence.

Branches in 22 Principal Cities

The Latest Development in Portable Elevators

The Lewis-Shepard WORM DRIVE STACKER

(Type P, 2½ h. p. Heavy Duty Electric Stacker) as shown at left.

The Stacker that's Different!

Worm Drive operating in oil bath. Longest and most satisfactory service assured.

NO EXPOSED GEARS

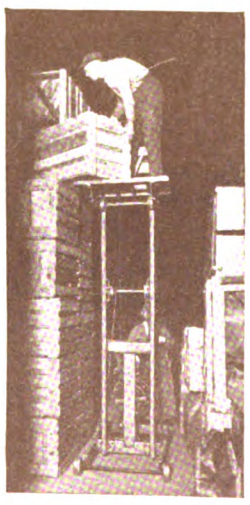
It will pay you to investigate this last word on Portable Elevators. We also make a hand operated Stacker and a combination (hand and ½ h. p. electric) Stacker.

No advance in Prices on Stackers and Jacklifts.

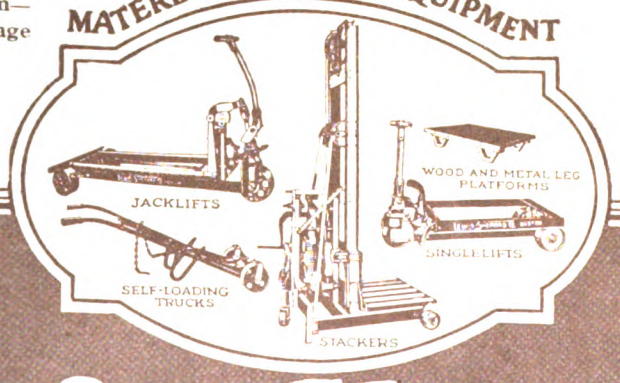
Send for Free Booklet "How to Make Air Space Pay You Rent"

Write us today at our factory address

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BOSTON, MASS.



LEWIS-SHEPARD MATERIAL HANDLING EQUIPMENT



Lewis-Shepard BOSTON

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in the swelling volume of aggregate production of articles of human use, which, because of its very volume currently marketed, shows the possession of buying power in millions and millions of consumers. Such increasing production of articles of human use could not be maintained if wealth and buying power were in the hands of relatively few fortunate possessors. The story is told, for instance, in this simple analysis of the twenty years between census points of 1900 and 1920:

Our population increased 40 per cent.

The volume of our food production increased 38 per cent., showing secure assurance of our home supplies.

The volume of mine production increased 128 per cent., showing a secure basis of service for the fabrication of industry.

The volume of our factory production increased 95 per cent., showing that 1920, with 40 per cent. more of population, there were produced articles of human use of double the quantity produced in 1900.

Moreover, eliminating from this volume of industrial product those articles which are currently consumed, such as food and clothing, there is a remainder of permanent addition to household and other human use which may be reasonably calculated to have expanded the general average of possession of the American home in 1920 to be three times the articles of human use as in 1900. This may be roughly checked by the most casual observation of how recently there has come into general use such things as plumbing, and bathrooms, and telephones and phonographs, and electric fixtures and automobiles.

Automobiles—In 1906 we had one automobile for 1788 of our people. In 1920, one for each eleven. In fourteen years we had progressed so that one in eleven had the use of an automobile, where fourteen years before it was one in 1800.

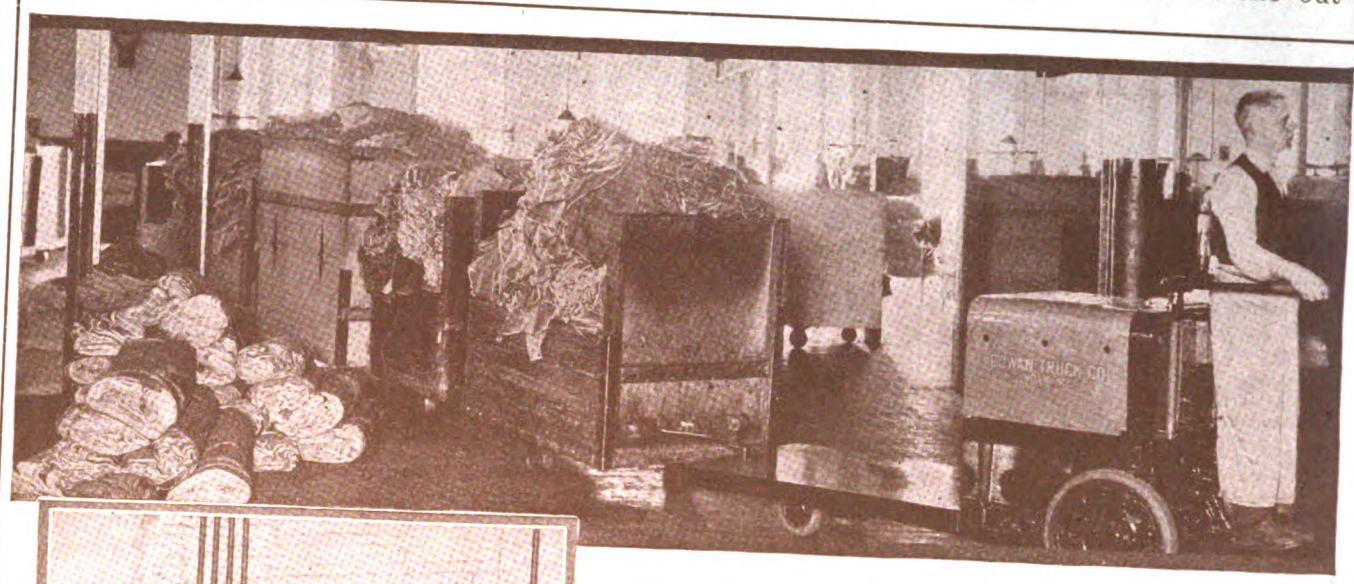
Telephones—In 1900 we had one telephone for each 84 of our people, and in 1920, one for each eight. That is in twenty years we had increased the use of the telephone in daily use ten times.

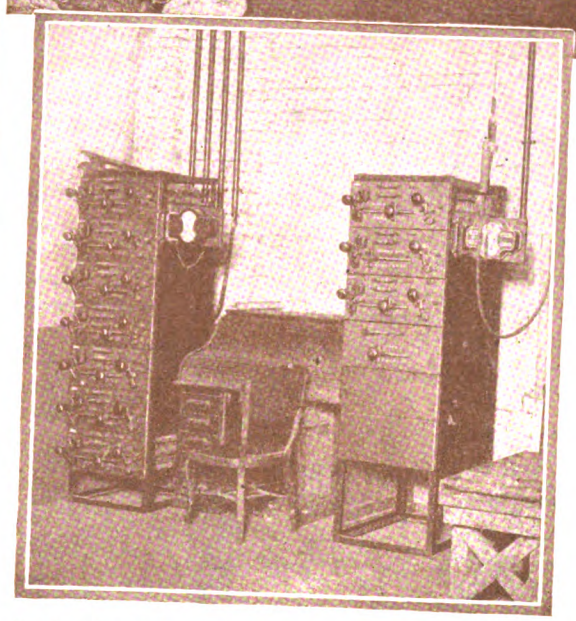
Electricity—In 1907, one to forty-five of our people used electricity, and in 1917, one to fourteen, in city and country.

Phonographs—We produced, in 1909, instruments to the extent of 350,000, and in 1920, two and one-half million instruments. Applying again a mathematical progression it indicates that in ten years we have put in the homes of this country fifteen million such instruments.

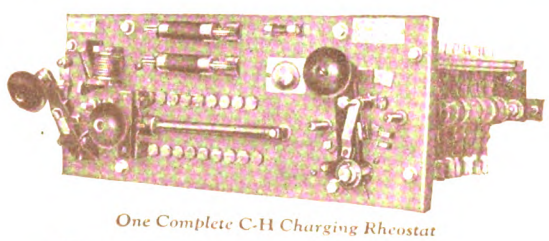
In twenty years we have developed in America four major industries that our fathers scarcely conceived. The automobile industry, the motion picture, the electrical and the chemical industries. Those four major industries, the development of the last twenty years, today afford a livelihood for probably twenty million people. They are maintained by the release of workers from agriculture and other industries, through the substitution of the mechanical production of science itself, so that we rely as never before on the continued service of science and invention translated into human needs through the processes of large-scale industry, distinctly American.

If there has been one out-





In the above illustration, the left-hand panel is built up of seven individual units or rheostats, each taking care of one charging circuit. At the right, three units are mounted at top with a discharge unit below. Space is available for two or three more units at bottom of this panel. The two lower slate fronts shown are simply blanks.



One Complete C-H Charging Rheostat

Two, three or more of these may be arranged on floor type panels and any number of panels located side by side or separately as space and conditions demand. Protection is provided against damage to batteries—a signal lamp is furnished to show when unit is connected up to a battery. Any attendant can be easily instructed in their use. Automatic types also made which are desirable where no attendant is on the job during the charging periods.

Prevent Material Handling Delays

Keep the Batteries Properly Charged

Your investment in battery-driven trucks is best guarded—and delays in material handling and production eliminated by keeping the batteries properly charged.

C-H Battery Charging Equipment is the result of experience in the design and manufacture of such equipment extending back to the first commercial uses of battery-driven vehicles and trucks.

Every provision for the correct charging and protection of batteries is provided. And each of the charging units or sections is complete in itself and alike in size so that additions can be easily made at any time as your fleet of trucks is extended.

Thus present and possible future requirements may be planned and space allowed—but *only the equipment you require to take care of your present fleet need be purchased now.*

Thousands of these units are in use in all parts of the country for the charging of industrial trucks, street vehicles, and battery locomotives.

Booklet 830 contains complete information. Ask the C-H office nearest you to mail a copy.

THE CUTLER-HAMMER MFG. CO.

New York Cincinnati Chicago Detroit
Boston New Haven Cleveland Buffalo
Pittsburgh Philadelphia St. Louis
Northern Electric Co., Ltd., Montreal, Canada

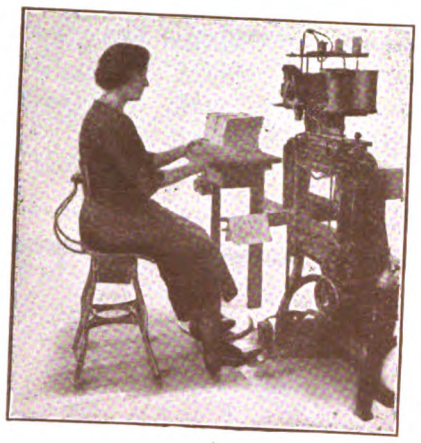
Works: MILWAUKEE and CHICAGO

C-H CUTLER-HAMMER CHARGING EQUIPMENT

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UHL STEEL Postur Chairs



The illustration shows seat tilted forward which brings the back with it. Note the straight line spine and the properly located back support

This bindery operator is scientifically seated upon a Uhl Steel PosturChair, which increases her production, furnishes comfort during the entire day. And, her body is in the position health demands it should be.



The Uhl Steel PosturChair fits the body. The seated skeleton shows correct support. Note how the pelvic bones are relieved by the seat shape.

Fatigue is the thief of production. Incorrect support of the body breeds poor health. No employer would knowingly sanction impairment of health resulting from wrong chairs. And, increased production is being sought by every means. The Uhl Steel PosturChair is the answer

PosturChairs have been designed in conjunction with, and are approved by the American Posture League of New York. Each chair bears label of approvel.

SPECIAL FEATURES: Made of cold rolled steel except seat and back which are wood. 10 heights each with 3" height adjustment. Seat tilts forward or backward. Swivel seats when wanted. Durably built, neatly finished.



This is the No. 8150-V WB, 28" high adjustable to 31". Nine other sizes. Note shape of seat. Sit in it and be convinced.

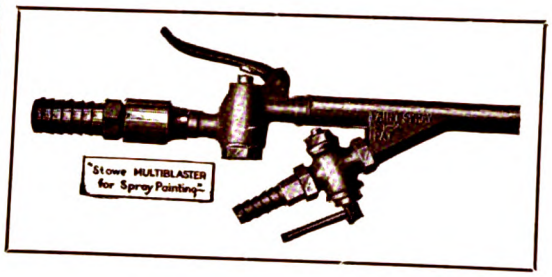
TRY ONE AT OUR RISK

If you are seeking more production and greater health protection for your workers, write us for a sample to try under your own conditions. It's free for two weeks use. Mention height needed Descriptive pamphlets available.

THE TOLEDO METAL FURNITURE CO.
1608 Hastings St., Toledo, O.
Manufacturers of steel equipment for factories, stores, offices and schools.

standing contribution which America has made to industrial processes, and their reflection into social service, it is the demonstration that production, stimulated and enlarged more and more, thus, by the very economy of cost which follows mass production and by the security of earning and buying power which follows its own enlarged employment, does raise directly the general standard of living; that enlarged production through mechanical aids so far from releasing workers to unemployment, does by its very influence enormously expand employment opportunity and make more secure the common standard of living.

The agricultural industry, for instance, is not commonly deemed to be one highly mechanized. Yet there are these significant indicators of the efficiency of that industry and the underlying service of the American adaptability to mechanical aids. The census of 1920 showed 1,700,000 fewer workers in agriculture than in 1910, but, notwithstanding this decrease in agricultural workers, there was increase in the quantity of each one of the important cereal crops, and this increase was as high as 30 per cent. in the case of wheat. Even under the "pre-war" comparison our cereal production increased from 4½ billion in 1913, to 5¼ billion in 1922. It is carefully calculated that the wheat crop of today requires the equivalent of seven million days of manual labor; but if that crop were today produced on the methods before the invention of the reaper, and its succeeding mechanical devices, it would require 130 million working days' labor. The reduction of 130 million days of manual labor to seven million typifies the premium America puts upon the release of human labor to the production of other articles of human use as fast as mechanical devices can accomplish that release. There are countries in the world today whose agricultural methods and agricultural implements are still those of centuries ago. The world which sometimes superficially criticizes our agricultural production per acre, is content to record an average of 1½ tons annual cereal production per



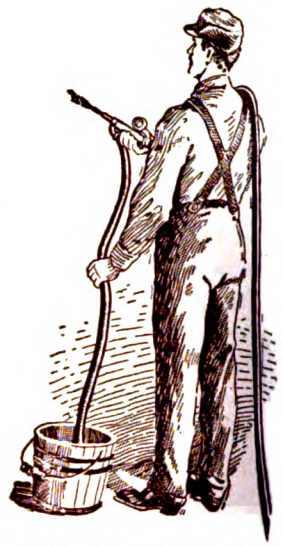
One Man Can Paint 3000 sq. ft. per Hour

—by the use of the Multiblasters. In this time he can give that entire area a thorough coating equal to two or three coats by brush! And aside from the time saved by eliminating the extra coats, the "man behind the gun" operating a Multiblaster can do six times as much painting as a brush worker.

There is Less Paint Wasted

by this method, and the fact that the paint is drawn into the spray by suction keeps the ingredients stirred up and aids in obtaining a uniform coat, also applying all preserving properties of the mixture.

May we send you via Parcels Post a Multiblaster **on 10 days' trial?** Ready for instant attachment to your air-lines—paint syphoned from any convenient container — **Price $12.00,** F. O. B., BUFFALO. Shipping weight 3 lbs. Requires 40-50 lbs., air pressure.



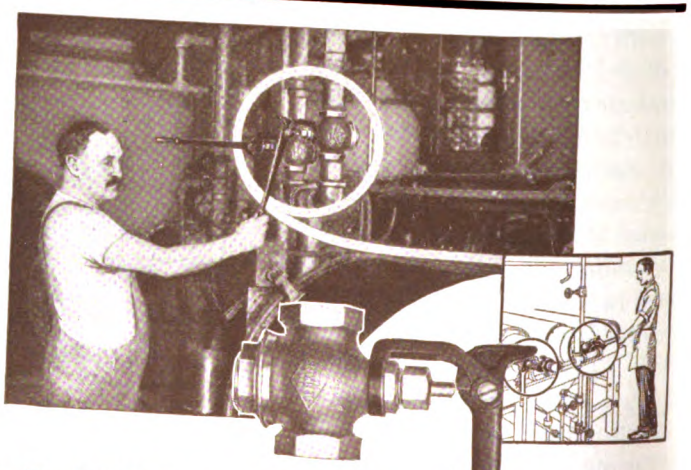
"The Man Behind the Gun"
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Geo. M. Stowe, Jr. Manufacturer

68 Forest Ave., Buffalo, New York

Makers also of Stowe Multiblasters for Sand Blasting

Multiblaster for Mechanical Application of Paint



This RAPID ACTION VALVE saves time

An instantaneous, flow with one quarter pull of lever—stays open automatically.

The Jenkins Rapid Action Valve fulfills a long felt need for a valve that can be opened and closed instantly without water-hammer, and that will automatically stay open without the aid of set screws, locking devices or other appliances.

It saves time and stops water waste in filling wash-wheels. Suitable for use at testing stations, for shower baths, dye works, hat factories, cloth shrinking machines, garages, or wherever a quick acting, dependable valve is required

Send for illustrated folder.

JENKINS BROS.
80 White St., New York, N. Y.

Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

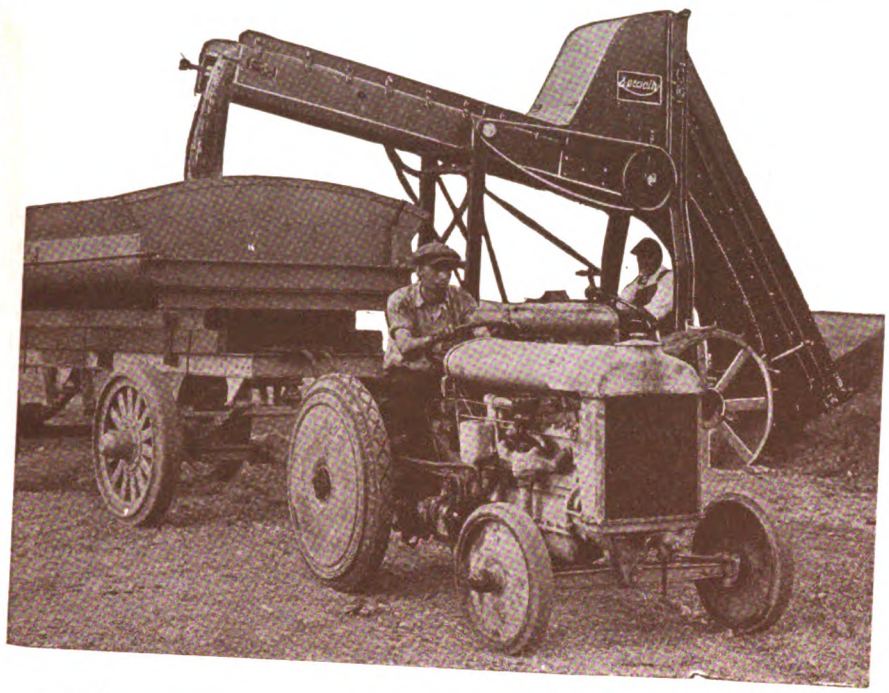
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Man Behind the
(COPYRIGHTED)

Specialty Engineering Co.

FORDSON LOADER



50% Less Labor Costs
100% Increased Truck Capacity

IF YOU are worried about next winter's coal supply, why not utilize your storage space now when coal is cheaper?

You can do this without added labor costs with the SPECIALTY Fordson Loader—a **high powered loader** for heavy duty, mounted on, propelled by and operated by a Fordson Tractor.

One firm reports a decrease in labor costs of 50% and an increase of 100% in their truck capacity. Another reports that the loader paid for itself in less than a month.

The Fordson Loader can be used for the handling of any bulk material in addition to coal.

The installation is a comparatively simple operation—any "Fordson" service station will do it in a few hours time. It is readily attached, no holes to be drilled or alterations to be made on the standard Fordson Tractor. The Loader operates at a most efficient speed when operated by the Fordson Tractor—approximately 1000 R. P. M.

The Fordson Loader is of rugged construction, yet easily moved anywhere.

Let us send complete description and prices or see any Ford Dealer.

for use in

Sand Banks, Coal Storage Yards, Sand and crushed stone, Reclaiming culm piles, Refuse foundry sand, Sand Pits and Mines, Unloading materials from cars, Excavated materials and other bulk materials.

Will do the work better than some Portable Loaders costing twice the price.



SPECIALTY ENGINEERING CO.
Allegheny and Trenton Aves.
PHILADELPHIA, PA.

worker, while America produces, under its typical American philosophy, 12 tons per worker.

If the corn crop of today were to be raised on the methods of 1856—before those special kinds of machinery especially adapted to replacing manual labor in the raising and garnering of corn were used—it would require, by accurate estimate (or so accurate that it shows the trend and tendency), at least one hundred and fifty million working days. Whereas, today, with these mechanical devices, the raising of a corn crop of the present size is estimated to consume forty-three million days, a vast economy in releasing manual labor to other industries producing other articles in human service. In these unique national ideals and national methods rests the secret of the successful competition of the American farm, with its American standards of living, producing an export surplus against competition, in the ultimate market, of cheap labor competitors. In these same national ideals and national methods rests the explanation also of the successful competition of our industrial production of highly paid labor, against the product of cheaper labor and of lower living standards.

In the light of a proper appraisal of these tendencies there is a new interest in trade records just recorded throughout a number of the basic industries.

For instance in March these records have been made:

Cotton consumption, largest ever recorded.
Pig iron production, largest ever recorded.
Steel ingot production, largest ever recorded.
Crude oil production, largest ever recorded.
Zinc production, largest since 1917.
Automobile and truck production (346,000), largest ever recorded.
Railroad car loadings, highest ever recorded for this season of the year.
Residential construction, largest ever recorded.
Sales of Life Insurance, exceeded only once.
Unfilled orders of locomotives, largest ever recorded.

Hang up your soap with a soap-holder



and you'll hang up a new record for low soap consumption.

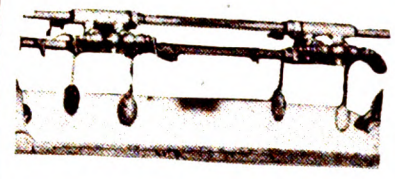
If we would Save you 50%

on the cost of the soap used in your employees' wash rooms and would prove it to you, and at no expense to you whatsoever, it would interest you, wouldn't it?

We can, and will prove it by sending you fixtures to equip your wash room, together with a sufficient amount of soap to give it a thorough try out, and remember it costs you nothing; neither does it place you under any obligation to us whatever. A genuine

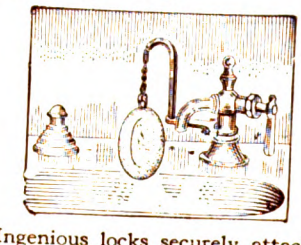
Free TRIAL OFFER

With the soap-holder—soap cannot be carried away, thrown on floor, or left in water to become soft, mushy and unfit for use—it cannot break up when worn and clog drain or make the washstand untidy.



One of many types

These soap-holders are made in many different types and designs. They are made of brass, heavily nickel-plated, or of German silver and extra strong to resist tough usage.



Ingenious locks securely attach the soap to fixtures by means of an anchor imbedded in the bar of soap.
Where these fixtures are installed—every ounce of soap is used.

Write today for full details.

ANCHOR CORE ECONOMY SOAP CO.
136 West Lake Street, Chicago, Ill.

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Volume of retail sales, 10-cent stores, largest ever recorded at this season of year.

Volume of mail order sales, largest ever recorded at this season of year.

The result of this expanded business activity is that the volume of aggregate production has now passed the peak of 1920. The measure of reassurance against the collapse which may follow hectic and feverish activity rests in the fact that the index of wholesale prices is 35 per cent. below the 1920 peak of prices.

That this material progress was not destructive of the educational ideals of our people is indicated by applying another test:

We had enrolled in institutions of advanced learning in this country in 1909, 226,000 students. In 1920 we had 416,000. That is, in eleven years the students in our advanced institutions have almost doubled.

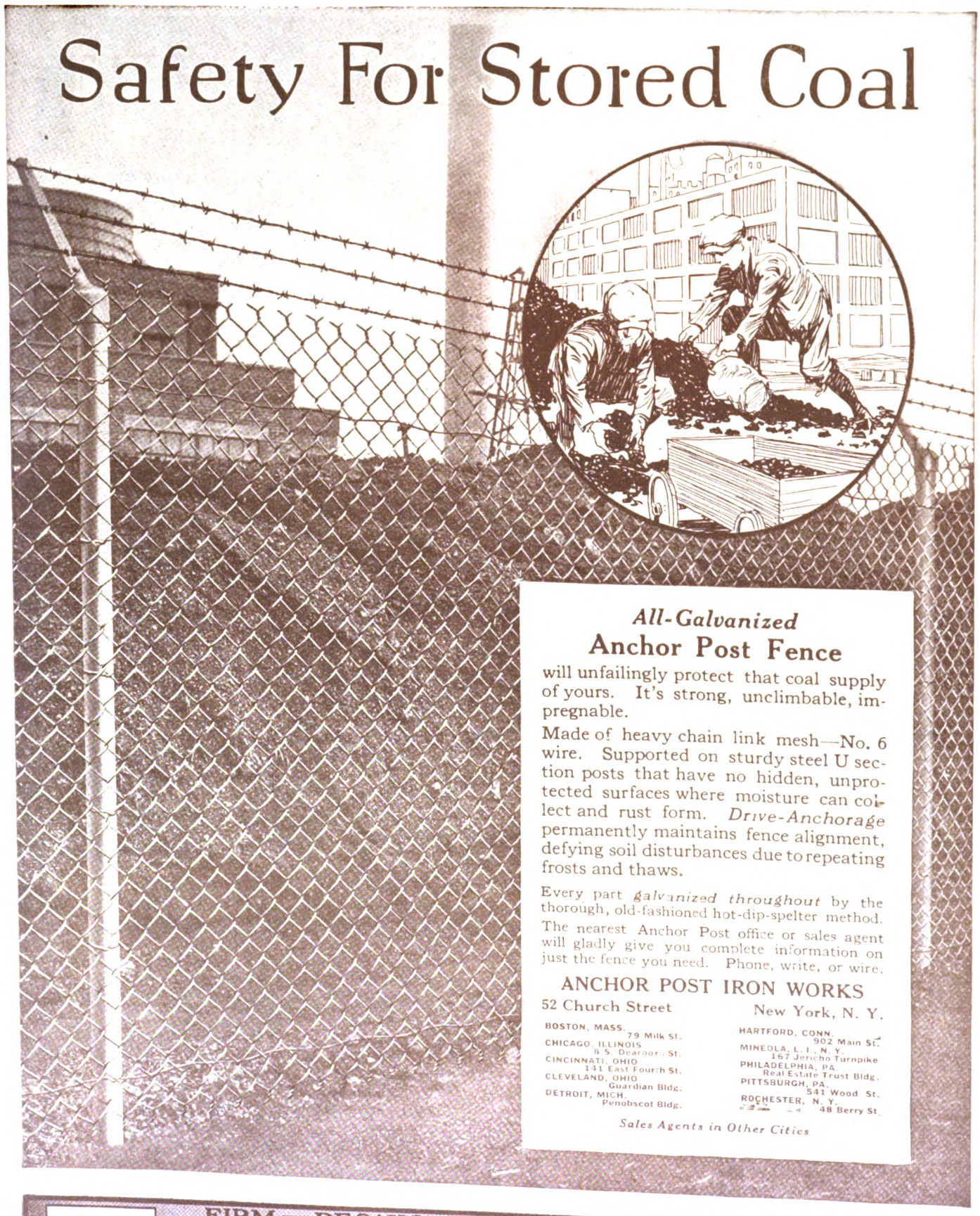
The same story extends through the elementary grades. In elementary education the expanding figures of attendance and the lengthening of average duration of school training are indicative of the increasing training in intellectual power, which must inevitably translate itself into more human capacity to understand and enjoy the finer things of life and to enlarge the human capacity to produce articles of common use which we indicate as an advanced standard of living.

The training which this gives the mentality of our people can not help but add to the general level of earning power throughout our whole country.

The significance of this story of industrial recovery and business activity rests in its accomplishment against a relative lethargy in recovery throughout the Old World. Even though the same tendencies to enlarged earning and saving power are present in Europe, they are manifestly of lesser extent.

There is, then, the very natural desire to know whether this leadership in trade recovery and the re-establishment of opportunity and employment on which rests human welfare, is vested in America primarily because of great natural resources and fortunate geographical position, or whether these results are due to causes that stimulate individual and national accomplishment.

In February an American delegation of some fifty members of the Chamber of Commerce sailed for a preliminary study of conditions in various countries of Europe and for a conference at Rome under the auspices of the International Chamber of Commerce for consideration of steps to aid European recovery from its after-war depression. Because there was the inevitable comparison of American ideals and American methods with those observed abroad, and because these crystallized at Rome in the expression of certain principles on which, alone, national and individual prosperity could be built, I venture to sketch here the background of observation and conclusions on which the American delegation based its recommendations at Rome.



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Egypt—A narrow strip of fertile soil irrigated from a great river, 4,000 years of occupation, recording only a total population of fifteen million people. The explanation of this restricted population growth rests on living standards and practices so defective that, in Cairo, the death rate exists of 75 out of each 100 children up to one year old. Ninety-eight per cent, illiterate, yet demanding universal suffrage and self-government, and pointing to the success of the American republic, with its ten generations of universal education as the justification for its own demands. Wealth in the aggregate, but wealth concentrated in the hands of a relatively few land owners and princes. Its great resource its cotton crop, but whether cotton is 10 cents or 30, the standard of average remains unaffected, at the very minimum. Dirt floors, no rugs, no furniture, even a general lack of table utensils. Its agricultural implements and practices largely those of twenty centuries ago. The plow for instance, having retrograded from the two-handled plow pictured on the chambers of the old temples to the single-handled plow today; otherwise the same. Nevertheless there is the beginning of a more general use of telephones, the telegraph, automobiles and other indications of the beginning of a national stirring with an aspiration for the earning power which allows common possession and creates consuming markets. A great port is developing at Alexandria with modern equipment.

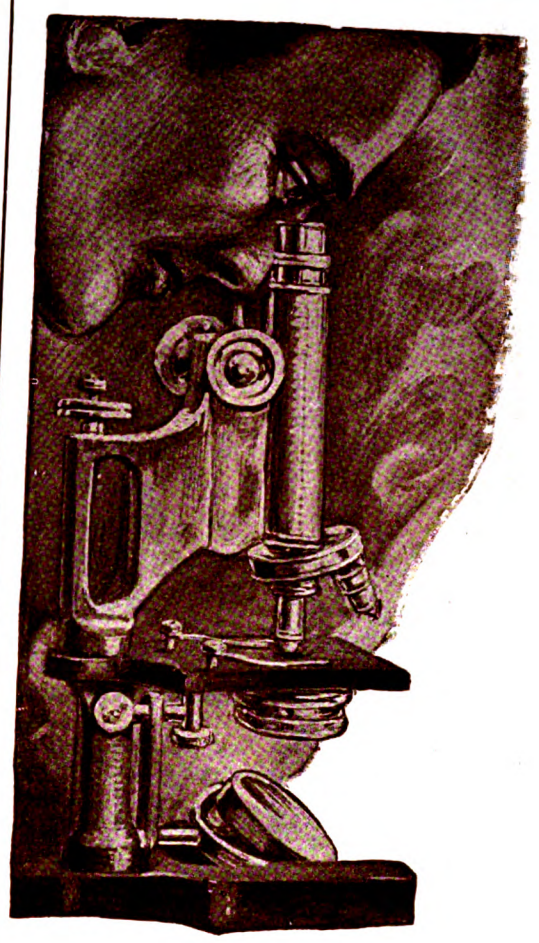
Palestine—Fertile fields, good roads, many autos, new buildings in town and country, an occasional tractor in the field, every evidence of national progress. A lack of safe seaports and the handicap of lighterage expense from vessels in exposed open seaways.

Turkey—A cleaner and more sanitary Constantinople. Evidence of enlarging use of tramcars, telephones and telegraph, and automobiles, which should be considered carefully in view of the fact that fifteen years ago electricity in any form was nationally prohibited. The usual difference of views as to the sincerity of intention and the administrative ability of the new Turk party now in power. Here too, the evidence of large populations beginning to reach after the possession of those things which enlarge human comfort and happiness, and the assurance that earning power which follows these aspirations will create steadily enlarging consuming markets throughout this Near East. Constantinople located to be naturally the trade capital of vast distribution. A stable government which secures life and property and stimulates productive industry, is the prime prequisite for a great national growth.

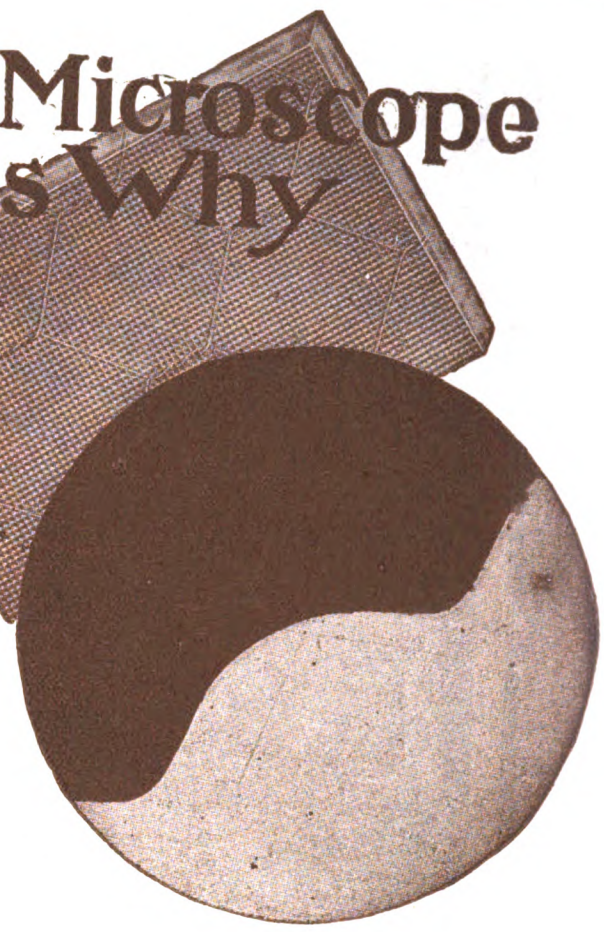
Greece—Only twenty per cent, arable land. A discouraging national finance position. A revolutionary government in control. A great problem of re-absorbing a million Greek refugees from Turkey. Still possessed of the resources of a traditional history which attracts tourists and travelers. Still possessed of the capital of an industrious people and the record of having surmounted in the past many similar crises in their national development.

Algiers—Manifestly prospering, under French direction.

(Continued on page 71)

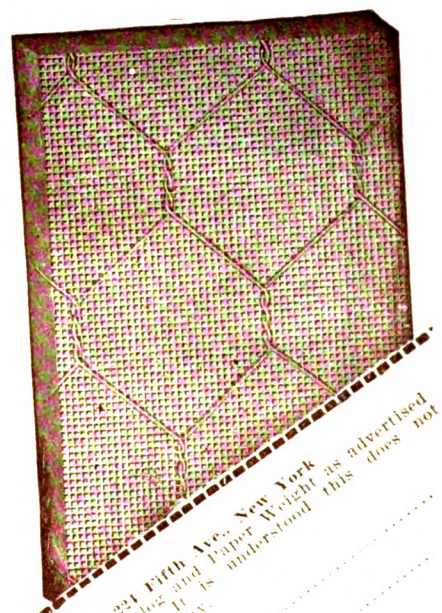


The Microscope Tells Why



FACTROLITE

Diffuses Daylight



Each little pyramid has **plane** sides but a rounded apex, and a rounded fillet between rows.

FACTROLITE is scientifically designed to prevent direct reflection of daylight, even when the light strikes at a narrow angle of incidence to the panes.

At the same time the maximum degree of **diffusion** is attained. The United States Government used FACTROLITE for a big building which required over 100,000 sq.ft. of this improved daylighting glass.

At a time when conservation of resources is a paramount need, why not consider the conservation of daylight?

A sample of FACTROLITE sent on request to any engineer. Simply fill out and mail the attached coupon

The Mississippi Wire Glass Co.

224 Fifth Avenue, New York

CHICAGO ST. LOUIS

Mississippi Wire Glass Co., 224 Fifth Ave., New York
Gentlemen: Send me a Catalog and Paper Weight as advertised in Industry Illustrated. If this does not obligate me in any way.

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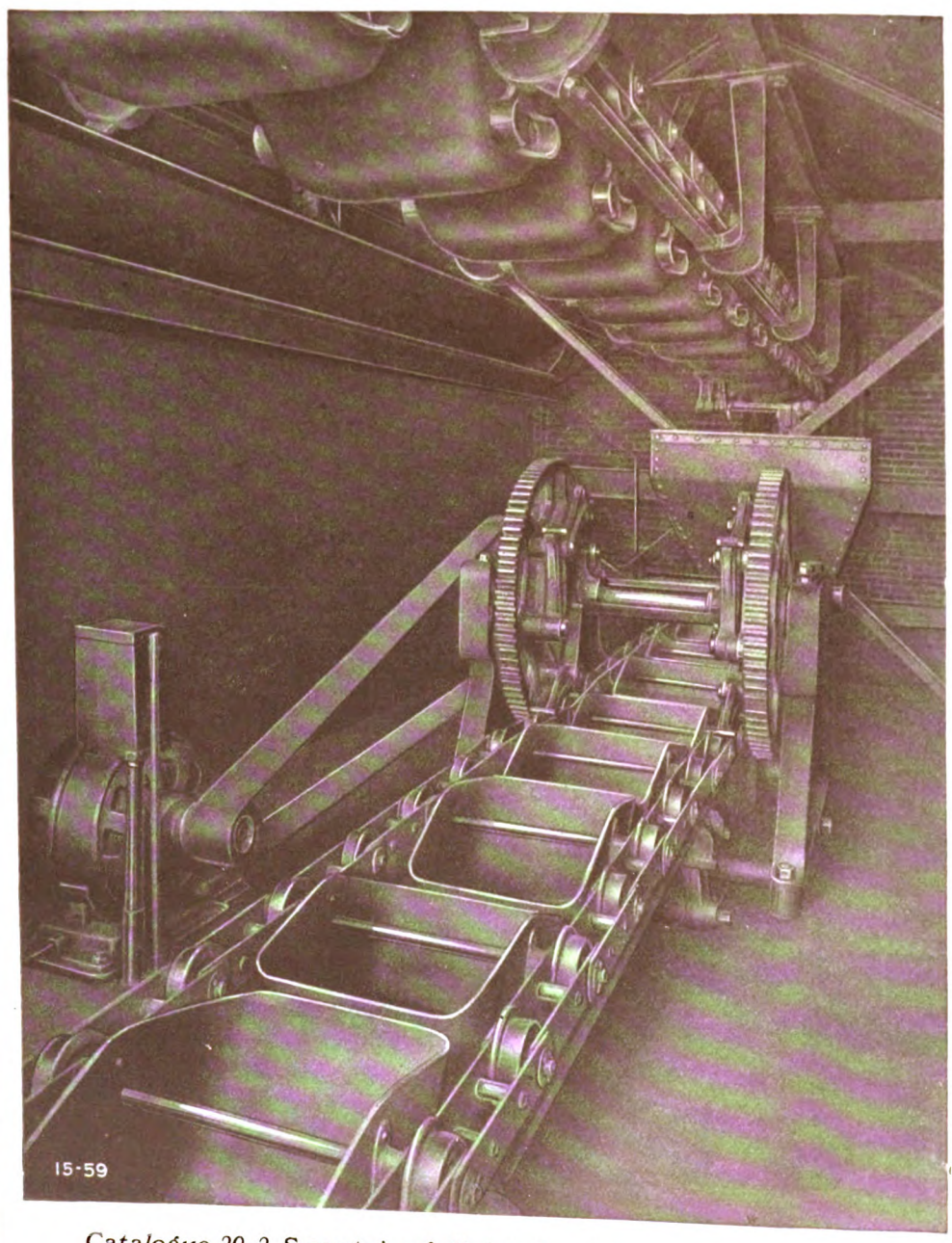
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Will You Read This?

IN an article on "Materials Handling" by Matthew W. Potts, in the May issue of this publication, Mr. Potts said:—

"It is strange that plant executives still have to be told of the many advantages that can be obtained by using mechanical equipment."



Catalogue 20-2-S contains full details with numerous pictures.

He describes and depicts handling equipment in use 128 years ago, among which is a bucket conveyor operated by hand, which he says, was "crude but effective."

If the "crude" apparatus of 1795 was capable of saving labor,—when labor was plentiful;—and saving money,—when money was not so stringent, how much more can be saved in these essentials by using the modern, highly developed Hunt equipment of 1923, when both labor and money are at premium.

This is the question with which every executive should busy himself without loss of time; and Hunt engineers, with the accumulated knowledge gleaned from over half a century experience in materials handling, can be of valuable assistance in helping plan labor, time, and money saving apparatus to fit every requirement of bulk, cased, or packaged materials handling.

Take for example the Hunt Pivoted bucket Conveyor shown here; installed 8 years ago at the Biograph Company's plant, New York City and still giving satisfactory service.

The picture shows clearly the details. To the left is the motor driving the gears to which are attached the *pawls;* which in turn engage the studs between the powerful steel links, *propelling* the buckets along slowly; thus relieving the wheels and bearings of the excessive wear due to driving by sprockets.

Driving by means of *pawls* is an exclusive feature found *only on a Hunt Conveyor*. This exclusive feature has made the reputation of the Hunt known throughout the world; because through this method of driving, the conveyor is given a longer lease of life as the wear is considerably less than with any other type; the operation is more positive and continuous. These advantages coupled with the saving in repairs and labor, are logical inducements for specifying Hunt Conveyors for super-service.

C. W. HUNT CO., Inc.

West New Brighton, New York City

New York Office—Whitehall Building

Phillips, Lang & Co., Inc.,
431 South Dearborn Street, Chicago, Ill.

Ernest F. Learned,
141 Milk Street, Boston, Mass.

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THE TOWMOTOR
VS
THE LABOR
SHORTAGE

THE CHANDLER MOTOR CAR COMPANY
CLEVELAND, OHIO, U.S.A.

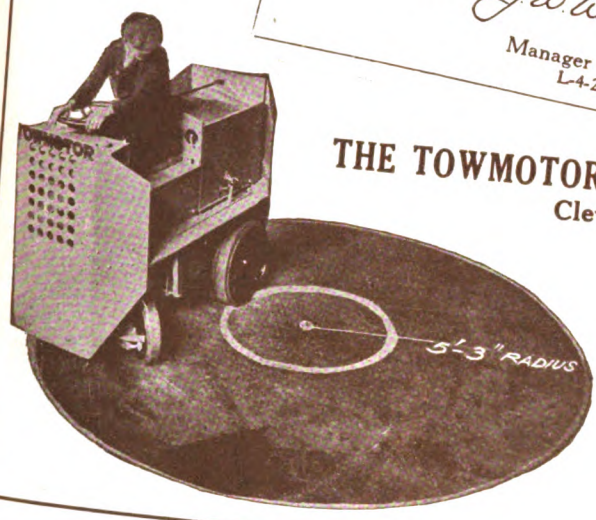
May 1, 1923.

The Towmotor Co.
Cleveland, Ohio.
Gentlemen:

In reply to your letter of April 26th pertaining to our experience with the Towmotor.

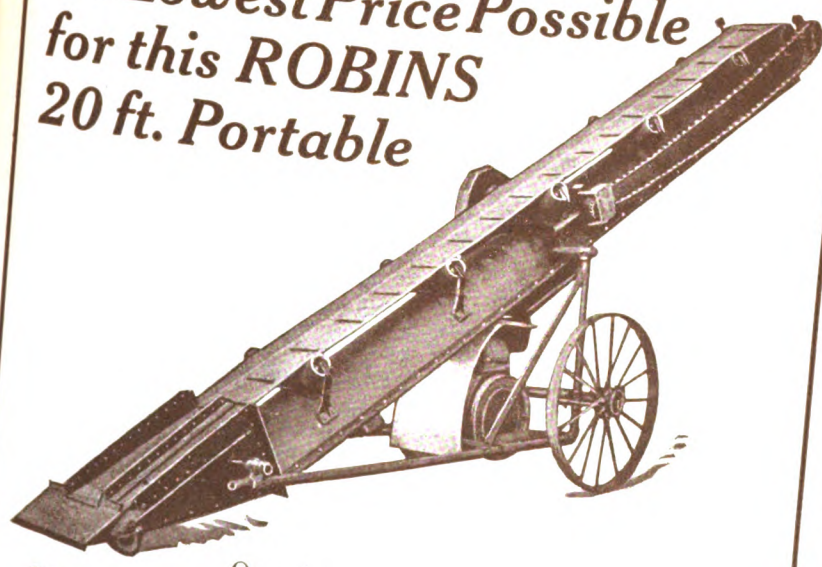
We are under the impression that it is the most essential feature in any manufacturing plant. We have no hesitation in saying that our Towmotor has paid for itself many times over, and can accomplish in one day the work of fifty men. Its durability and upkeep under rough usage are more than surprising.

Very truly yours,
THE CHANDLER MOTOR CAR COMPANY
Signed: J. W. Whitehouse
Manager of Service.
L-4-26-23



THE TOWMOTOR COMPANY
Cleveland, Ohio

The Lowest Price Possible for this ROBINS 20 ft. Portable



PRICE
$433.00
F. O. B. Passaic, N. J.
This price does not include power unit. With 2 HP. A.C. Motor—$94.00 additional.
With 5 HP., "New-Way" gasoline engine—$175.00 additional.

Quantity production enables you to obtain this remarkable Portable conveyor at the low price of $433.00—with features superior to some of the higher priced conveyors.

16" Troughed Belt—large carrying capacity—self-cleaning and arched frame—fully protecting the return belt from dirt accumulation.

Rugged construction—well balanced. Capacity of one ton per minute.

Place your order now to insure early delivery.

Write for Bulletin No. 570

Robins Conveying Belt Co.
New York Chicago Pittsburgh Boston

(Continued from page 69)

A modern port under construction for its expanding commerce based on its own increasing production.

Italy—New life and energy. A general confidence in its future, possessing the great resource of an industrious people, few natural resources but manifest progress in realizing on its hydro-electric possibilities. Its confidence in the future typified by such ports as Palermo constructing a modern harbor and modern warehouses by American contractors using American capital. An ancient city, but possessing miles of asphalt streets and new residence districts that compare favorably with Minneapolis or Los Angeles; planning to attract and care for the distributive trade of the Mediterranean. Throughout all Italy, in all classes, a great rallying to the Nationalist movement, symbolized by the Fascisti. A great national fervor evidenced by Latin oratory and marching songs, but also sustained by a great general appreciation that national progress is made by work and devotion. A strong man in control, one forced by the logic of demonstrated failure to change socialist convictions for maturer appreciation of individualism and private enterprise, moving with determination to put State services into more efficient private direction, determined to lift the burden of unncessary personnel and depressing State expenditures, and with every evidence of clear progress toward a sound national budget and the rebuilding of national and individual prosperity.

Austria—A demonstration of the ineffectiveness of parliamentary government under bloc groupings, brought to bankruptcy by the easy immorality of the socialist conception of State care for the individual, unable to set its house in order except by appeal to stronger and abler directions, tying its own hands by constitutional abdication of parliamentary interference for two years as a condition for administration by the League of Nations, putting into effect by stipulation of this League administration sounder national policies of taxation, reducing its State expenditures by elim-

(Continued on page 73)

ELWELL-PARKER



HAND OR ELECTRIC TRUCKING?

Time has nearly passed for choosing.

ELWELL-PARKER
Electric Industrial Trucks and Tractors

are available now
but common labor is not

ELWELL-PARKERS
lift, carry, and place the loads where wanted.
They will deliver eight times the load at three times the speed of a hand trucker.
They are always ready, work early and late. Many operate 23 hours per day.

60% of all handling can be done by these units. May be driven practically any place a hand truck can be pushed.

Thousands in operation in over 200 branches of industry in 23 different countries. Tried and proven equal to every inside haulage requirement. Many have been in continuous service for over 10 years.

ELWELL-PARKER
trucks are guaranteed to save from the very start.

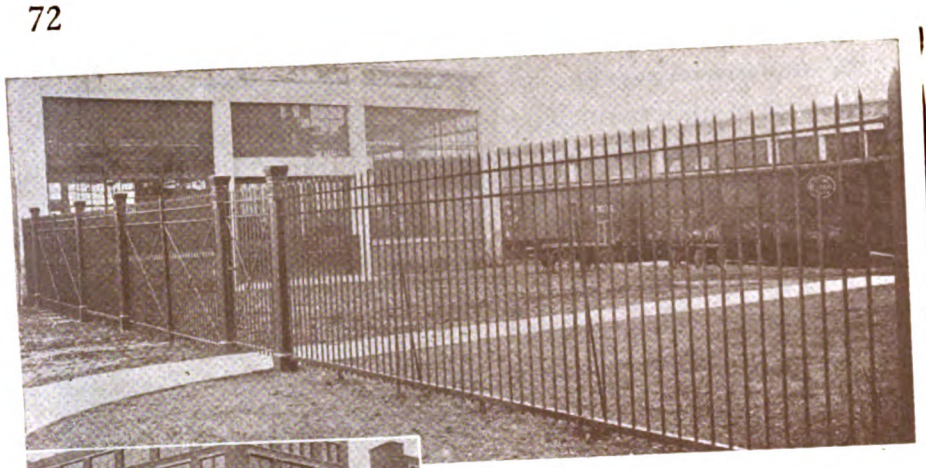
SELF-LOADING TRUCKS
DUMPING TRUCKS
CRANE TRUCKS
LIFT TRUCKS
TRACTORS

Our unobligating survey is yours on request, or ask for Bulletin 51.

ELWELL - PARKER
ELECTRIC COMPANY,
CLEVELAND



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Fine Fencing Like This

Is a permanent, positive protection against industrial hazards. And the cost of this protection is extremely low—much less than you think. Besides good fencing, all iron or chain link, adds greatly to the appearance of your plant and increases property values.

Get a price on the fencing or gates you've been wanting. Write today for our catalog. See a blue print of the fence as it would appear installed—and know the cost. It will pay you.



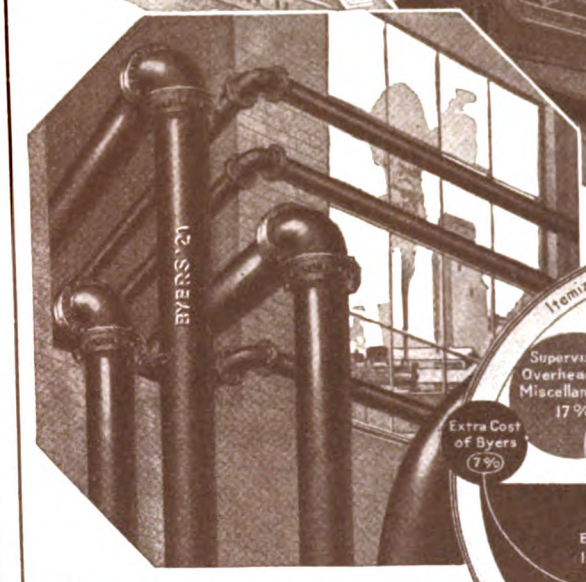
ENTERPRISE IRON WORKS
1112 E. 24th St. Indianapolis, Ind.

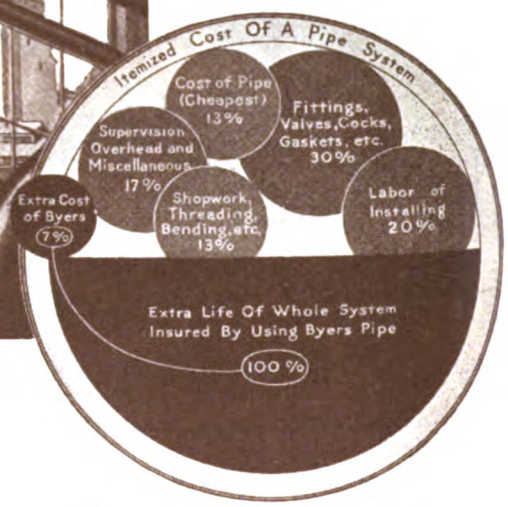


BYERS PIPE

GENUINE WROUGHT IRON







Denver Post Office. Byers pipe used in plumbing and drinking water systems.

Count the Cost

but count it correctly

THE choice of pipe for any plumbing, heating, power and other pipe system, is dependent on its price as well as its rust-resistance. The aim is to use pipe which will last as long as the useful life of the building or structure of which it is a part.

If the structure is expected to serve its purpose for 50 years, and the pipe rusts out in 25 years, then the pipe is dear at any price.

Because Byers pipe, installed upwards of 30 years ago, is invariably found in excellent condition in buildings everywhere, it may, in the vast majority of cases, be expected to last as long as the structure of which it forms so essential a part.

You might use pipe which costs much more than Byers, and gain nothing in *useful* life. Or you might get cheaper pipe, which would lower the initial cost of the pipe system by only 5 or 10%, but which would rust out long before the building has outlived its usefulness.

In both cases you lose.

Prevent this loss by specifying Byers pipe—the most economical long-life pipe for plumbing, heating, power and industrial pipe systems.

Based on installation cost, the extra cost of Byers pipe is trifling. See diagram. Ask for Bulletin No. 38, "The Installation Cost of Pipe"

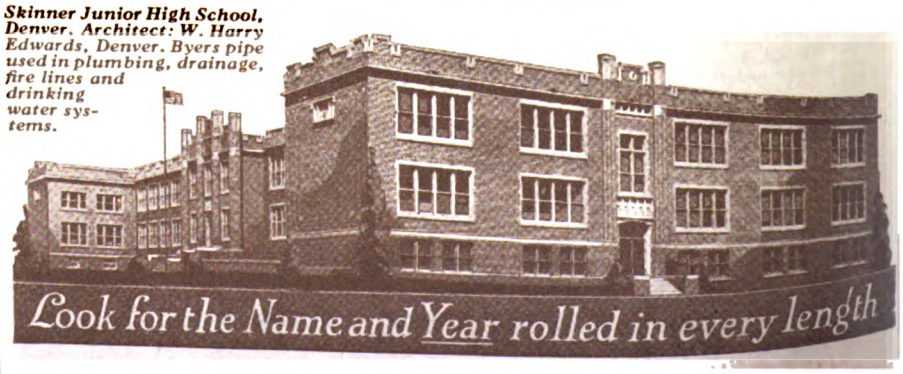
A. M. BYERS COMPANY, PITTSBURGH, PA.

Established 1864

New York Philadelphia Boston Chicago Cleveland Houston

Distributors in all Jobbing Centers

Skinner Junior High School, Denver. Architect: W. Harry Edwards, Denver. Byers pipe used in plumbing, drainage, fire lines and drinking water systems.



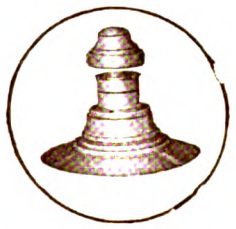
Look for the Name and Year rolled in every length

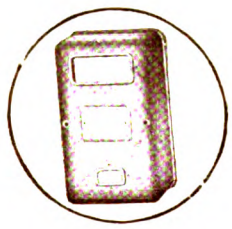
G.P.&F. Service
Knowing How Since 81

Let us figure on

STAMPINGS—

Sheet Metal Parts







When you consider G. P. & F. Service as a source of supply for your Stampings and Pressed Metal Parts the equipment that turns out 100,000 parts daily and a 15 acre plant are put at your disposal

We also develop pressed parts for replacing castings, forgings and wooden parts.

Over 41 years experience in the work.

Send blue prints or samples—we'll send estimates promptly.

GEUDER PAESCHKE & FREY CO.
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Over 15 Acres of Floor Space—

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PIP
T IRON



OF A Pipe
Fittings, Valves, Locks, Gaskets, etc. 30%
Whole System ing Byers Pipe
OST

(Continued from page 71)

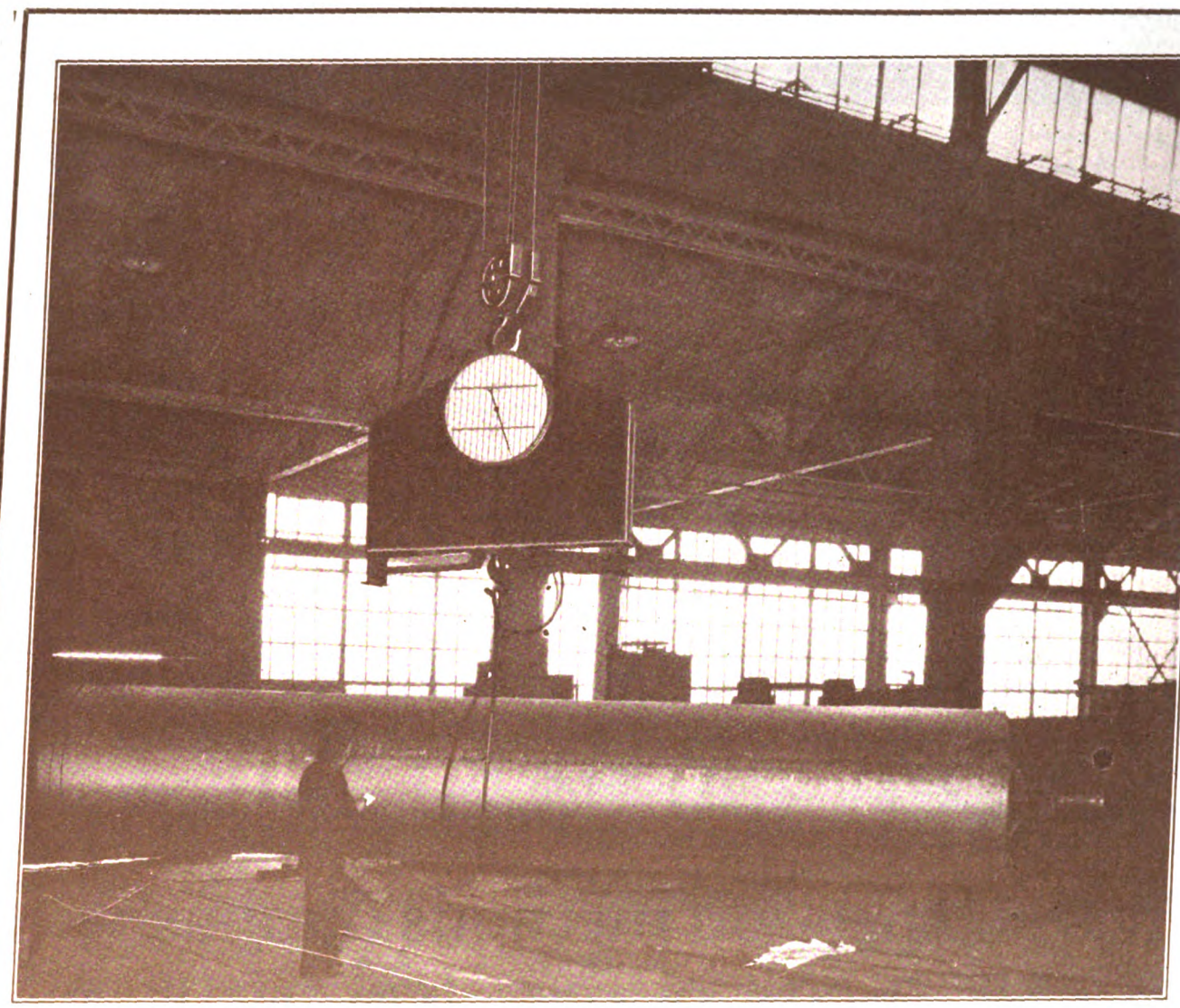
inating unnecessary personnel, discontinuing further issues of paper monies, resulting in a natural stabilization of the Austrian crown and, again, resulting in the disclosure of an unsuspected buying and saving power when people are thus relieved of the fear of currency depreciation loss, savings accounts increasing 600 per cent. in four months. No vacant stores, houses or apartments in Vienna. A gradual revival of national economic life, reducing the charity-fed children in Vienna from 300,000 to 10,000, largely remaining orphans. A new hope and courage, a stimulated effort to complete trade agreements with surrounding countries, by which the age-old experience of Vienna in the direction and financing of industry throughout Central Europe could be made again effective across newly-constructed frontiers which for three years have blocked the former channels of trade and commerce. A considerable progress in this direction. An able administrator sent to Vienna by the League after seventeen years of administration as Mayor of Rotterdam, convinced himself by study and experience on the ground that Austria will be successfully recreated.

Czechoslovakia — Ninety-eight per cent. literate, a great nationalistic spirit, a sound national budget, a stabilized currency, with the passing handicap of relatively large unemployment, against the surrounding depreciated money countries which are still capitalizing the tradition of value which still adheres to the name of "Mark" and "Crown," waiting patiently the day when producers and workers can no longer be deceived by the nominal designation of a money token and production costs must be equalized, knowing that then their sound conditions for government and industry will give them their rightfull leadership.

Poland — Showing distinct progress in its industry; railroad service good; surprising its friends by an adaptability to self-government which disproves the tradition of Polish inability to govern by conference and concession. Confident also of a day when the revival of national life in Russia will facilitate its own.

Germany—Unusual difficulty in reaching conclusions, some building expansion, considerable restoration and fresh paint on buildings and homes, shortened employment in industries feeling the restricted supplies from the Ruhr, with wages made up to full week earnings by government doles, continued record emission of paper marks inevitably producing distrust of the artificial mark stabilization undertaken by the government, 18 per cent. official bank discount rate, passive resistance policy and unsettled reparations with possible developments, make all opinions of trade conditions and outlook of doubtful value.

France—Industrious as ever, fully cultivated fields, many tractors, good roads, restored railways and waterways, busy towns, 350,000 imported workmen to make up the equipping of its industries. Every evidence of individual earning power with a margin of saving which, with the confidence of its people in its government, will probably provide a continuing source of investment



At the Lasker Iron Works, Chicago—KRON CRANE SCALE
Weighs without a *Second Lost* —

KRON
Dormant Scales
Portable Scales
Suspension Scales
Crane Scales
Larry Car Scales
Monorail Scales
Counting Scales
Industrial Car Scales

BOILERS and other heavy materials up to 20,000 lbs. are weighed on this KRON CRANE SCALE without any time lost—without any additional labor cost.

The KRON is always on the job—never on the payroll.

Send for the KRON Booklet, "Load and Look." It gives many labor saving weighing suggestions. Fully illustrated. Why not write for it now.

AMERICAN KRON SCALE CO.,
430 East 53rd St. New York, N. Y.
Canadian KRON SCALE CO., Montreal, Canada

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power especially confined to France as long as the franc value is prejudiced against foreign investments.

Great Britain—Its house in order, able to relax taxation which was voluntarily assumed in re-attaining the financial leadership of the world. Its pound sterling practically back to gold parity, although carrying the financial burdens of some of its allies. Some unemployment but steadily decreasing. Some signs of improvement in its carrying trade which is the indicator for all its conversion industry. Its utterances not quite so pessimistic. Its efforts, as always, unrelaxed and persistently directed along sane effective channels.

Russia—With the restoration of some opportunity for private enterprise and with the return of a measure of inducement for private attainment, beginning to rise a little from the level of almost utter barbarism to which it had sunk under communistic mal-administration. The low water-mark typified by the official statement at Genoa in 1922 of actual production, in a great agricultural country, of plows at 13 per cent. of pre-war; agricultural implements at six per cent, of pre-war; and cast iron at two per cent. of pre-war production. Apparent evidence that a country which used to contribute 250 million bushels annually to feed the world, has succeeded in producing food enough to relieve famine this year and to contribute ten to fifteen million bushels of export, surplus. Able to dress its window by an occasional sleeper, and even diner, on its railroads. Exciting the wonder of the world that 150 million people, possessed of vast stretches of fertile country, great forests, natural resources of coal and metals, with two thousand years of social progress elsewhere for its guidance, can finally by the simple expedient of recognizing the primary individual human impulse, make the first steps in establishing living standards above the barest requirements of food and clothing. Hopeful, nevertheless, that the record of utter destruction under communistic practices and the record of even the most trivial recovery of opportunity for the individual, will point the way when this country will be re-entered, in the processes of domestic and foreign commerce.

At the general session of the International Chamber of Commerce in Rome, March 24, 1923, the following resolution of production was moved and adopted:

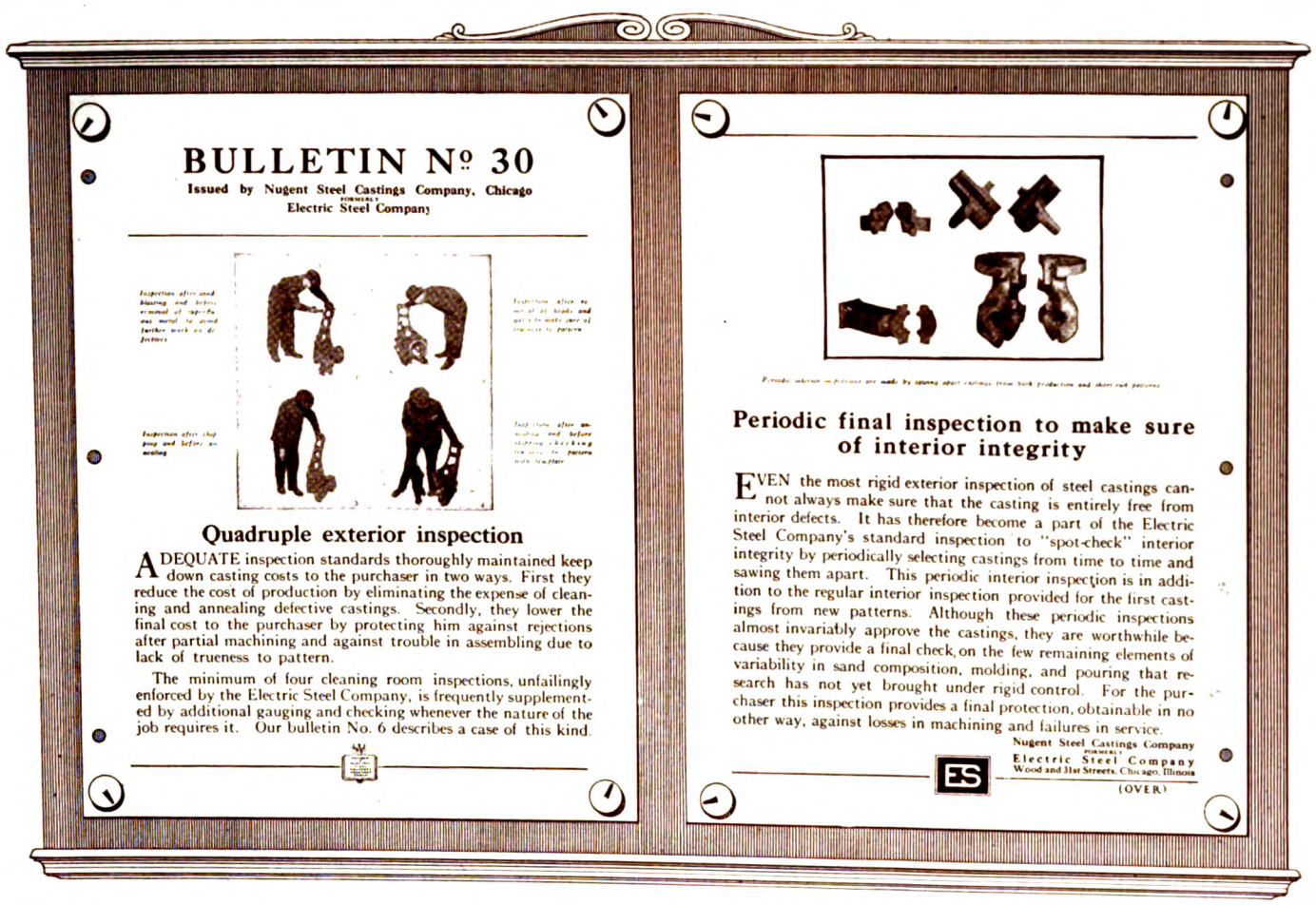
Whereas, it is increasingly clear that the national wealth and community and individual prosperity depend to a large extent for maintenance and increase on expanding individual production in all lines of industry and that the greater the production, the greater the benefit to all concerned, and

Whereas, international credits to facilitate production and exchange of goods can rest only a sound basis of material values, and

Whereas, real costs of production in various places and in various lines remain abnormally high and efficiency of production and individual output frequently remain lower than before the World War, and

Whereas, the present depressing burden of after-war

(Continued on page 76)



These inspection methods diminish the cost of cast steel parts

Lowering costs in two ways

THE thorough inspection methods that modern steel founding has developed are of great importance to the manufacturer using cast steel parts in his assemblies. As described in the bulletin reproduced above, these methods lower costs in two ways.

By eliminating the expense of cleaning and annealing defective castings that ordinary inspection would not reject until they reached the shipping floor, the cost of production is materially reduced. By protecting the purchaser against rejections after partial machining, the inspections reduce the cost of using cast parts. In addition, the assurance of absolute trueness to pattern that these methods provide, protects against assembly and machining troubles.

Pioneering new developments

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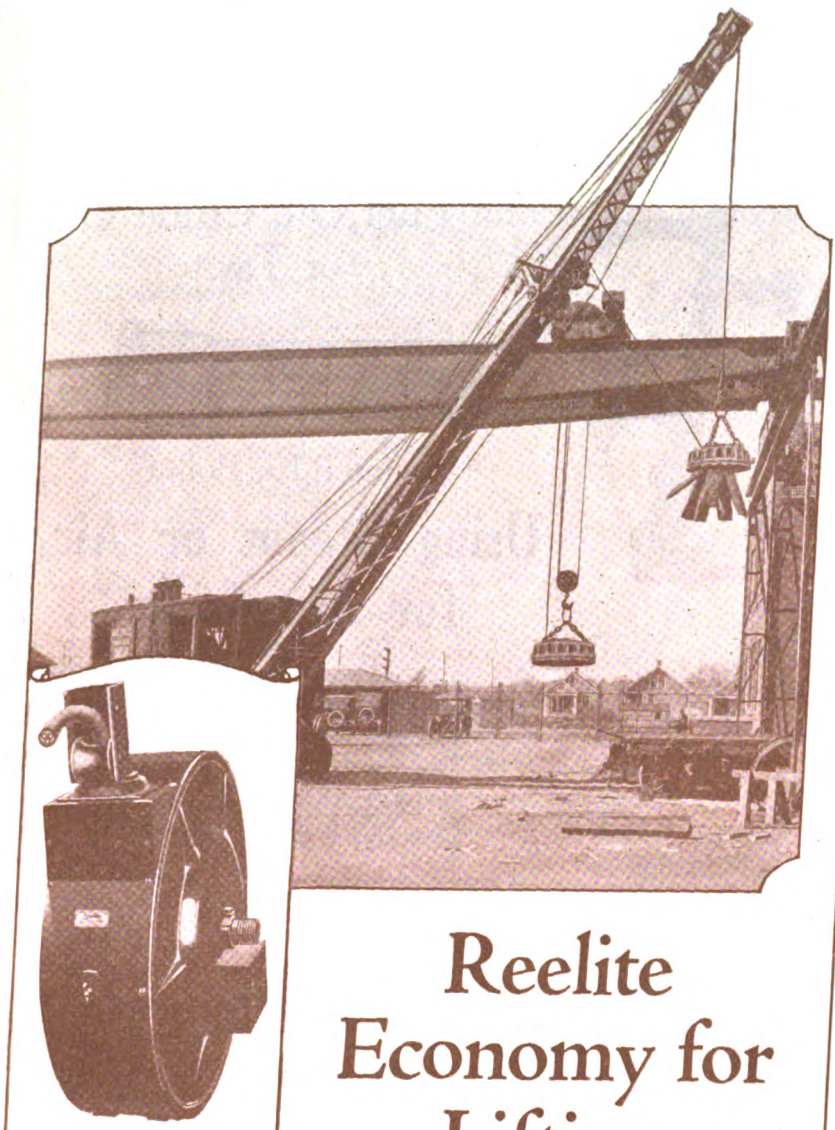
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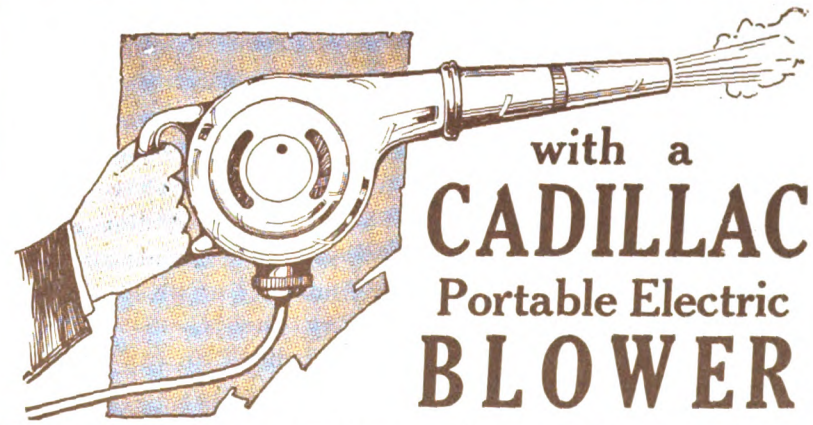
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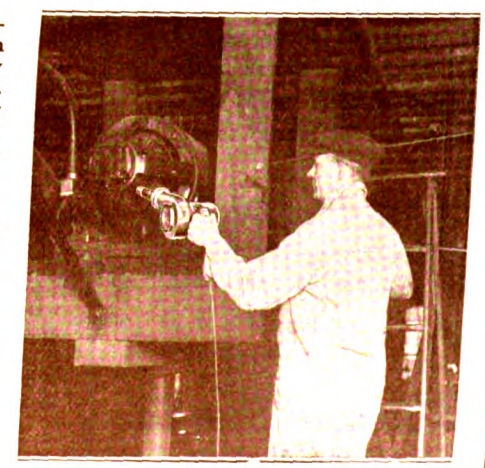
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(Continued from page 74)

responsibilities to be liquidated by taxation of workers and producers, can be best alleviated by increasing individual production and especially by increasing the output of man-power through the service of science and invention, which should not be hampered or defeated by artificial rules and arbitrary restrictions, and

Whereas, national figures of accumulated wealth and the published records of particular lines of industry and particular industrial establishments offer eloquent evidence of the benefits derived from the introduction of scientific and efficient methods.

Therefore, be it resolved, by this Congress of the International Chamber of Commerce, that the following principles be recommended for increasing production:

1. Enlargment of production by every invention and mechanical device which offers economy of production.

2. Elimination of all artificial restrictions and recognition of the need of maximum individual output on the part of all concerned in production.

3. Stimulation of individual effort by personal remuneration based on relative individual output.

4. Governmental policies which encourage existing industries and the creation of new industries—especially by a lowering of taxation as soon as possible.

5. Adoption of governmental policies which will permit not only taxpaying ability on the part of directors of industry and workers, but also opportunity to save and give the incentive of security in the enjoyment of the earnings of exceptional ability and effort.

6. Recognition and assurance of the advantages of private ownership and operation of business enterprise as contrasted with State ownership and operation, such State operation having been proved by experience to involve burdens of unnecessary personnel and other expense, and difficulties of adjusting charges for service, all of which hamper rather than stimulate production and economy.

7. Taking immediate steps to see that men engaged in nonproductive pursuits are diverted as soon and as generally as



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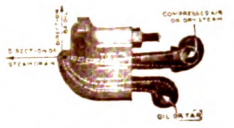
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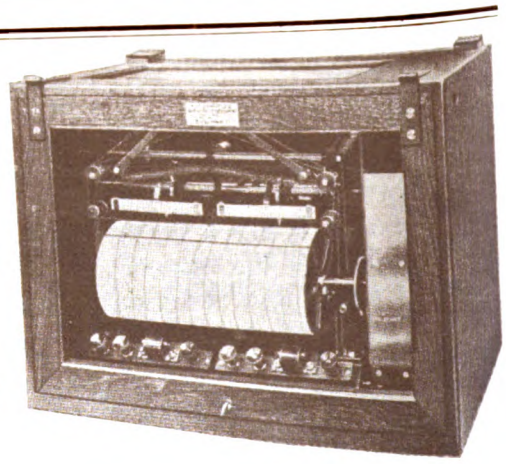
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possible to productive labor.

The American Delegation favored the adoption of this resolution, although in several respects they would have preferred its statements stronger and more clear in support of a theory of production which they believe is today, vital.

America realizes with all due humility the great natural resources bestowed on it by nature. It recognizes the freedom of experiment afforded it by a state of social relation free of age-old traditions and prejudices which might otherwise hamper its ready adaptation. But with all acknowledgment of these conditions which favor it beyond many other peoples, America also claims with due pride that it has developed most largely the service of enlarged production in its contribution to human progress and therefore to human happiness.

It realizes that the general average of possession, the thousand things of daily use which by division among all the people, constitute what is expressed as the "standard of living," can only be increased in the hands of the individual by production which enlarges its output more and more all the time. Moreover, that this expansion of human possession by having more things to divide can only be effectively created by producing more things per individual worker.

Aggregate production to be sure, is a thing greatly to be desired but aggregate production secured with greater numbers of workers fails of the full human service possible by expansion per individual.

It is the history of this great social development that enlarged production and especially enlarged production per individual itself creates and enlarges its own market, both by the economy of costs which follows such production and by the enlarging buying-power which follows the earnings which increased competive employment accompanying increased production itself affords the worker.

More and better food, shelter and clothing; carpets, furniture and tablewear, electric lights and appliances, phonographs and pianos, bathrooms and telephones, motion pictures and automobiles; all these owe their wider distribution in common use to this great economic process.

No truth has been so clearly demonstrated as that this practical philosophy of enlarged production contributes thus directly through human service to enlarge the means of human happiness.

To-day, the issue is directly joined between this theory of intensified production with its vast human service; and the stifling fallacy that there exists in the world only a certain limited amount of work to be done and that by restricting the output of each worker there can be more workers employed in securing this given quantity of production.

The man who in his nominal hours of work restricts and reduces the amount of effort and the amount of product which during those hours he can sustain; the organizations of men which designate and limit a day's work to be the laying of 300 bricks when a fair workman could lay 1200; the organizations of men, that by the power of concerted action, force observance of arbitrary rules requiring several men in the discharge of tasks, other-



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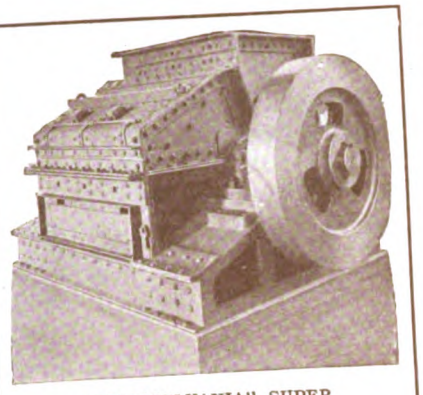
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wise performed by single workers; the men or organizations of men who oppose in this short-sighted deadly social fallacy the introduction of scientific appliances which release men to other productive industries; these men and these organizations are enemies of human progress.

Their attitude is a direct social injury to every man, woman and child. This story of limitation of output is especially a blow at the opportunity of their fellows, for workers require more and more articles for common use, brought more and more by the inevitable economics of intensified production, within their reach.

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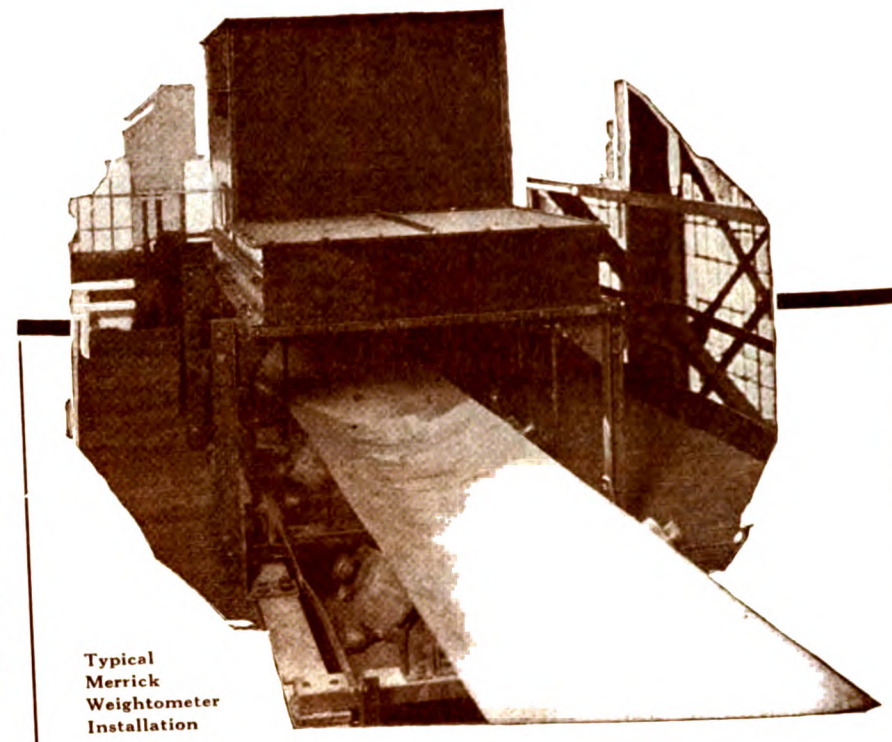
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WEIGHS WHILE IT TRAVELS

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Dissecting the Good Old Rules

By P. M. Fogg

PONDEROUS platitudes have their place in our lives. We all need the occasional stimulus of mental "bitters" to tone the fagged will. An injection of psychological "dope" now and then stirs up the rheumatic props of purpose to greater activity. For human nature is prone to sag in the middle.

Yet, as in the case of all medicines, judgment should govern the size and frequency of the dose. Caution must be observed lest the wrong bottle be selected in the dark. It must not be supposed that cure-alls are existent for any and all mental ailments.

Many a discouraged, heart-sick worker who has faithfully followed the good, old rules as laid down in the text books, is wondering today why they do not seem to work out in his case. With honest sincerity of purpose he is throwing himself heart and soul into his job, determined to win. He has perhaps been doing this day after day, month after month, and year after year; and he has been giving the very best that is in him. Yet he is still so close to the bottom of the ladder that he can easily reach down and grasp the hand of the chap who hasn't even begun to climb.

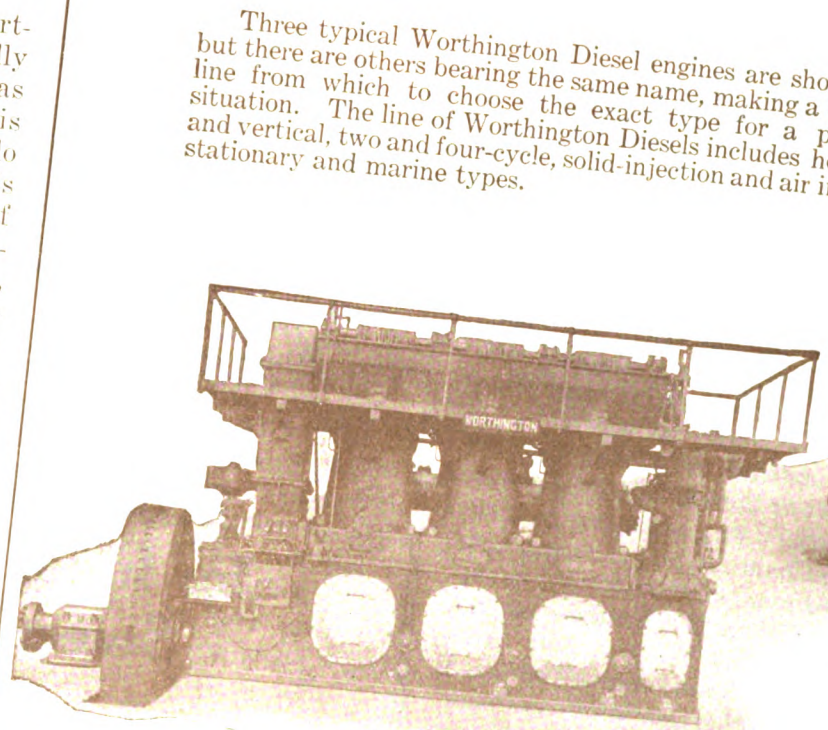
The rule book says, "Plenty of room at the top." The magazines tell us how the big executives have strained their eyes looking for the man to whom they can safely entrust that ten thousand dollar job. Employers wring their hands and cry, "If only the employee would prepare himself for the job ahead of him, then when the golden opportunity comes—that is, when his boss is promoted or resigns,—he will be fitted to step right into the place."

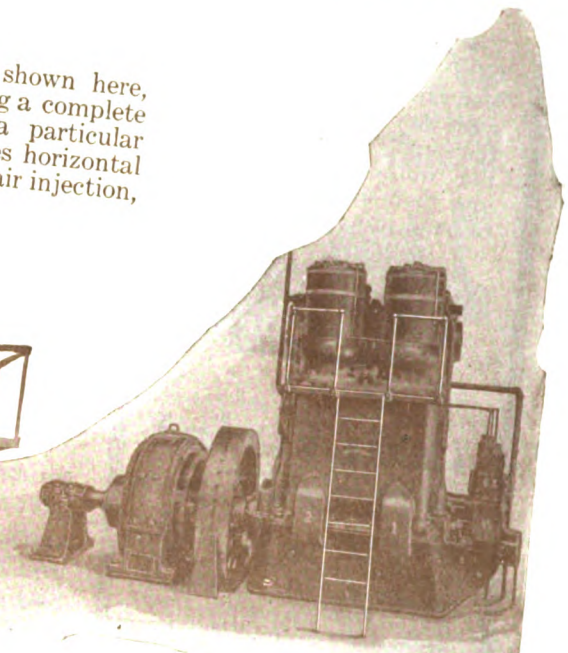
Meantime George slaves over his ledger, and Nellie comes to sell ribbons, and Harry is still driving the truck. George notes with some cynicism that his boss, the head bookkeeper, is likely to stick where he is for life—his ambition having expired long ago. It looks very much as though the road ahead is blocked. Nellie can see no light ahead in her little groove. "I have a fat chance of landing the buyer's job here," she says, "even if I do know as much about ribbons as the factory does." And Harry can see himself grown grey headed before he can progress more than two short steps above a truck driver's position.

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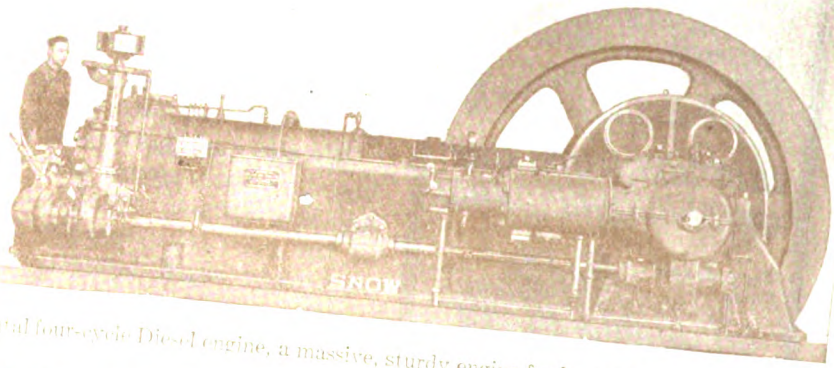
Three typical Worthington Diesel engines are shown here, but there are others bearing the same name, making a complete line from which to choose the exact type for a particular situation. The line of Worthington Diesels includes horizontal and vertical, two and four-cycle, solid-injection and air injection, stationary and marine types.





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say to these worthy souls that they are the exceptions to the rule. No rule can be all-inclusive, we may tell them. We point to the ones who have advanced; we extol their thrift, expert knowledge, and ability to think for themselves. "These are the ones," we reply, "whose records indicate the functioning of the rules. Go and do likewise." Then we pass out the little pamphlets of inspirational literature.

In justice to themselves, what should the workers think of all this? What are the facts as found in the average place of employment?

Not long ago, a frank, illustrative statement appeared in one of the periodicals devoted to industrial management. It had been written by a factory manager, and was of a nature to jar severely the serenity of the pet theories. For it stated that in any large industrial organization the great body of workers hasn't a chance large enough to be found with a microscope, to advance in accordance with the time honored rules. The exceedingly small percentage selected to become foremen, managers and presidents is virtually negligible. Not a chance in the work to which they are giving the best part of their lives! This is only another way of saying that the mill hand, if he ever aspires to become anybody of consequence in the business world, must quit being a mill hand, and become something else. The highly complex condition of industry offers opportunity to but very, very few of those in the lowest stratum. Such jobs must be looked upon as something to be escaped from at the earliest opportunity, if the worker has initiative.

We all know this to be a fact, but it doesn't sound pleasant, and it is disturbing to our faith in the good, old rules to have somebody blurt it out in cold print.

It may be argued that far too many wage earners are not properly located in society, with regard to their individual abilities or latent talents. Granted, and yet our factories continue to operate and the mills to turn out merchandise. Society is using the worker, whether or not he is properly situated economically. And we have only begun to give serious attention to his having



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selected the wrong job. Yet we continue to point out that by virtue of unremitting toil, and the force of will power and sheer grit, the worker may some day direct the great wheels of the industry in which he plays a small part.

Go into the office where George is bending over the ledger sheets and glance at the white collared chaps. Is it always the hard worker, who is just a step ahead of his job, keen and alert; is he the one who always finds himself singled out for promotion or for advance in salary? Ask the gray headed man who faithfully guarded his employer's interests for years, in his own little niche, only to see a smooth talker from outside the ranks slip into the vacancy at the top, and proceed to make a showing of economy by reducing the force. Those with records of five, ten, or fifteen years of service—out they go along with others. Perhaps they are a little too old, or it may be that their salaries look too high to the new manager.

Talk with the embittered ones who have seen favoritism stalk unhindered when advancements were being distributed. They will tell you that in their own cases at least, the rules cannot be taken at their face value. Office politics, a close friendship with the boss, a little flattery here, subtle influence there, similarity of organization membership, or perhaps an old grudge still smouldering—all the frailties of human nature are as likely to be present when the worker's opportunity arrives, as are the remembrances of faithful efforts to rise through adherence to the policies of the rule book. It would seem that a precept which is good for the worker to follow ought to dovetail into an equally good one for the manager to recognize.

The truth of the matter is, that we have all been schooled from infancy to look to the very top of the peak as the only worth while goal. Thus we have been prone to consider the road along which we are travelling merely as a means to an end—something to be passed over as quickly as may be. Every boy is solemnly told that the Presidency of his country is open to him, just as to every other native born citizen. He is encouraged to keep his eye on the job ahead of his own, so that some day—some day—he may become the head of the firm, "Stay where you are, and grow up with the place; don't jump around from one job to another," he is advised.

The boy advances to manhood, if to nothing else, and if he is willing for others to do his thinking for him, as many are, and finds after some years of service that somehow the rules have not proved themselves in his case, he is apt to become a sour, disgruntled individual.

If the boy had been taught to believe that the rules are theoretically correct, but that in all but a pitifully small number of cases the worker must find his chief satisfaction in work well done, in service performed to the very best of his ability; would this not help to create for him a more satisfactory type of philosophy?

In only one case out of a thousand will the worker ever be known except by his check number or as Bill Jones, the clerk. There will be no swivel chair, no limousine, no handsome salary for but a very few. Then why not lay the facts before the boys from the very start? Why not train the thousand future workers to be happy at being efficient in little jobs? All but one of them will remain in a comparatively small job. Why should we take steps to create discontent through false hopes?

Society must always have the lowly worker—the man who sweats in the dirt, dust and grime—the chap at the bottom of the ladder. And we shall always have our rule books with their inspiring phrases. These rules are not wrong in principle, but actually they will never apply but to the very few. If we add to them inspiration for even the lowliest to absorb, and teach him to be happy in the realization that "he also serves who only stands and waits," then we shall have created a wider field for the cultivation of contentment. For "many are called" to serve, "but few are chosen" to lead.

Measuring the Product or Measuring the Man

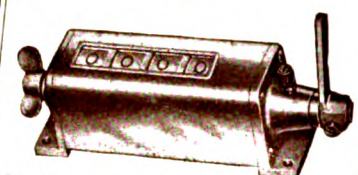
Counters measure both the product and the man, at your machines. *WHICH* counts for more?

In its effect on *results*, getting the *workman's* measure is the more important, for the fact that you have his production-record on a counter assures always a *better* record than otherwise.

So look for more than accurate records; look for substantially more *PRODUCTION* from

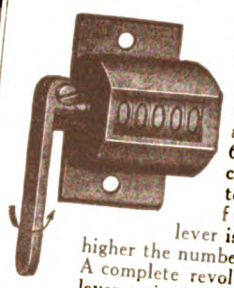
Veeder COUNTERS

The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines, where a *reciprocating* movement indicates an operation.



Registers one for each throw of the lever, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $11.50—subject to discount. (*Cut less than ½ size.*) Set-Back *Revolution* Counter of similar model, $10.00 (list.)

This small Rotary Ratchet Counter (No. 6) counts reciprocating movements of the lever, as required for recording the output of innumerable small machines. When the lever is moved through an angle of 40 to 60 degrees, the counter registers one. The further the lever is moved, the higher the number registered. A complete revolution of the lever registers ten. This counter can be adapted to no end of counting purposes, by regulating the throw of the lever. Price, $2.00. (*Cut nearly full size.*) Small *Revolution* Counter, also $2.00



FREE—This new 80-page booklet shows everything you could ask in a counter. Ask for copy.



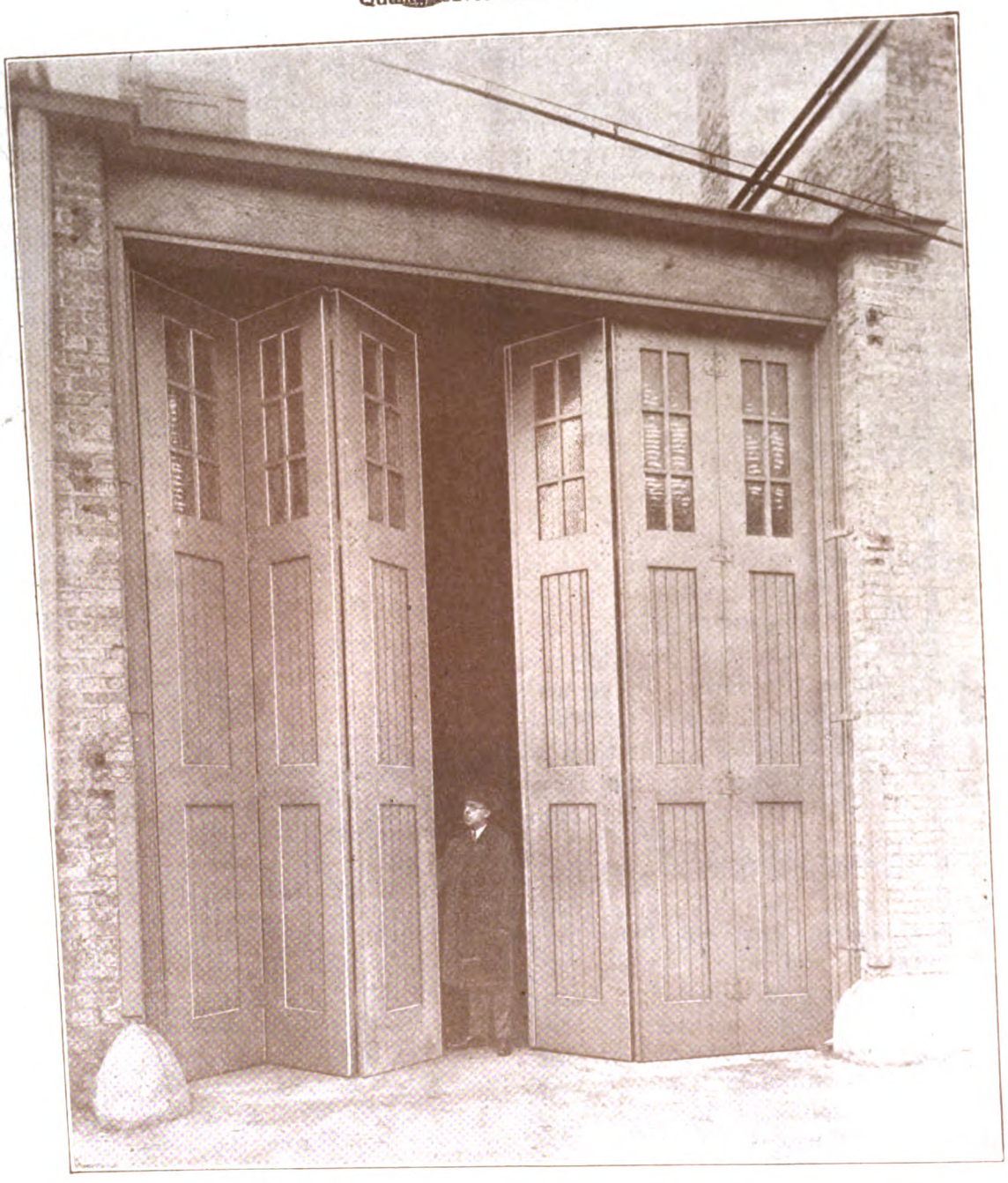
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"Slidetite" Industrial Door Hardware has successfully solved this problem in numerous instances. A typical **"Slidetite"** installation of this kind is that at the J. A. Torstensen Company, Chicago, shown in the illustration above. The doors are 21 feet high to permit trucks loadedwith large lights of plate glass to pass through. These doors move smoothly and easily in spite of their great height and bulk.

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Write to Department V for full particulars regarding **"Slidetite."** Our Engineering Department is equipped through wide experience to assist you with suggestions and plans. Bring your door problem to us.

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"A Hanger for any Door that Slides"

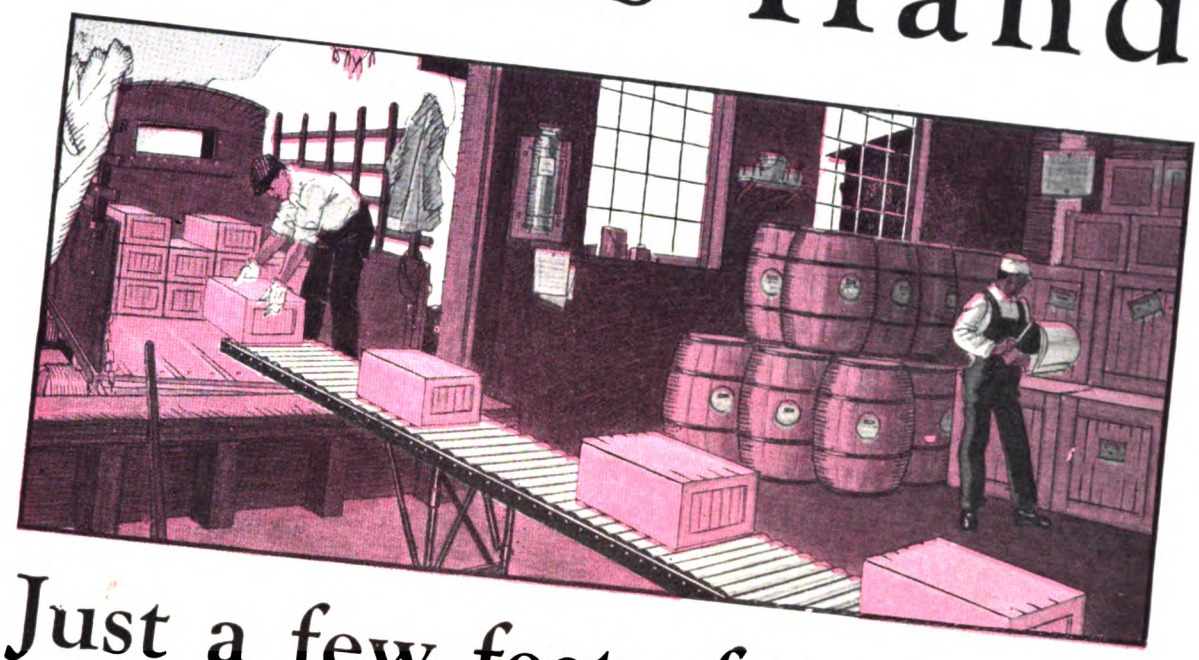
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Hand-Less Handling



Just a few feet of conveyor *but they do the work of many hands*

HOW long does it take to load cars or trucks at your shipping-room door? If the handling is done by human hands, you are delaying the outward flow of goods. If your men place boxes and packages on hand-trucks, wheel them out to cars or trucks, and there handle them again, they are wasting energy and time.

Short sections of Lamson Gravity Conveyor would cut handling and rehandling costs to a minimum. They would speed up loading, do the work in half the time, and release hand-truckers for productive work.

There is enough handling and rehandling in almost any factory, warehouse, or wholesale establishment to warrant the use of a few short sections of gravity conveyor. They are easily movable and can be set up in receiving-room, in storeroom, between manufacturing processes—in any place where conveying service is needed.

The initial cost of Lamson Short Section Conveyors is small. After installation they cost practically nothing to run, for the weight of materials or products carries them to their destination.

Where you can use short sections

Loading — Boxes can be rolled in and out of trucks in half the time it usually takes to unload and load. Labor is also cut in half.

Between Machines — Gravity conveyors keep work moving at an even pace that gives uniform production. A section like this soon more than pays for itself.

As a Work Bench — Gravity conveyors serve as a work bench along which workmen adjust and inspect products and crate them for shipping.

Packing — Gravity conveyors allow men to pack the goods and seal the boxes as they move by them in a constant stream.

Test these short sections

Perhaps hand-less handling is just what you need in *your* shipping room, or in other parts of your warehouse or plant. A few sections of Lamson Gravity Conveyor will do the work of many hands. A short trial will prove their efficiency. You can easily add to the first units later.

A Lamson engineer will gladly show you how to get the best service from our gravity conveyors. Meanwhile, if you desire further information concerning short sections of Lamson Gravity Conveyors, we will send you catalogs describing them in detail.

THE LAMSON COMPANY
SYRACUSE, NEW YORK
Branches in Principal Cities

Lamson Conveying Systems

LAMSON SERVICE

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LUMBER



3 men sometimes 8 men released for other work—$4,400 saving

From report by William H. Taplin, Supt.
of the Edward Hines Lumber Co., Chicago.

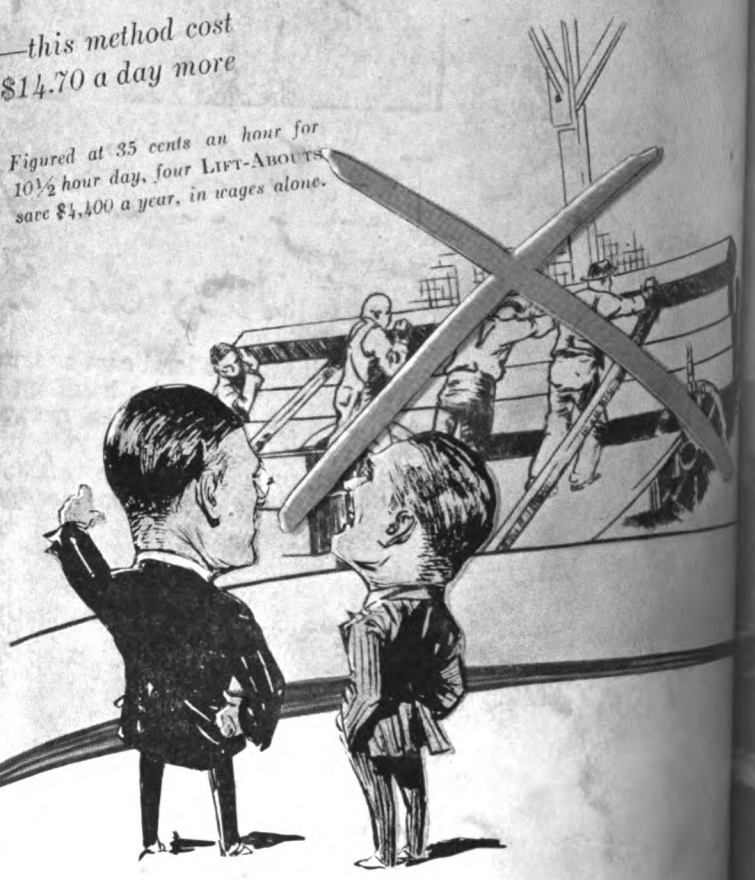
"HANDLING lumber is not an easy task—its size makes it awkward to handle and its weight usually requires a number of men to lift it, and besides considerable time is consumed. With this the situation, we are, of course, always interested in equipment that will make our task easier. Therefore, when we learned of the Shepard LiftAbout we immediately saw in this something of big value to us.

"In our planing mill we handle timber from the wagons to the machine tables and then back to the wagons. Here's where we saw an application for the Shepard LiftAbout—and on June 1st we purchased two LiftAbouts. The timber handled runs as large as 16 by 16 inches and varies in length from 20 to 60 feet. Although these LiftAbouts are called one ton cranes, we have lifted as much as 3150 pounds with them—and no doubt could lift more.

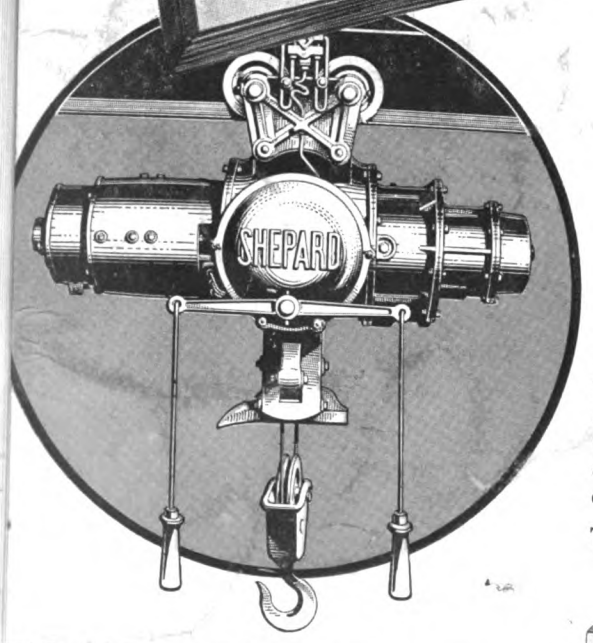
"Each LiftAbout replaces 3 and sometimes as many as 8 men when the heavy timbers are being handled. This is about one-third of the time, so figured conservatively each hoist saves us one man's wages.

—this method cost $14.70 a day more

Figured at 35 cents an hour for 10½ hour day, four Lift-Abouts *save $4,400 a year, in wages alone.*



A Shepard Electric LiftAbout Book of Illustrated Economies



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A REVELATION in material handling economies—remarkable savings, many beyond the expectations of the most sanguine.

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AUGUST 1923

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A Scene in the Cleveland Steel District

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For Economical Material Handling Use Hyatt Equipped Lift Trucks

No time lost—no labor wasted—one man with a Hyatt bearing lift truck does the work of 3 or 4 men with old fashioned trucks.

The use of lift trucks with the wheels rolling easily on Hyatt bearings is a sure means of speeding up production, cutting handling costs, avoiding plant congestion and keeping truckers contented.

These economies are not only effected when Hyatt bearing lift trucks first come on the job but continuously throughout the life of the trucks because the bearings are durable and need no attention except oiling three or four times a year.

Thousands of plants are benefiting by the use of Hyatt bearing lift trucks for handling materials. Are you?

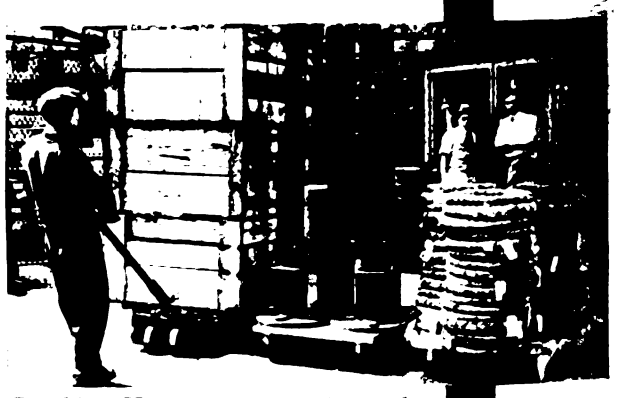
Secure these economies for your plant by using lift trucks equipped with Hyatt roller bearings.

Hyatt Roller Bearing Company

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Barrett-Cravens Hyatt lift truck.



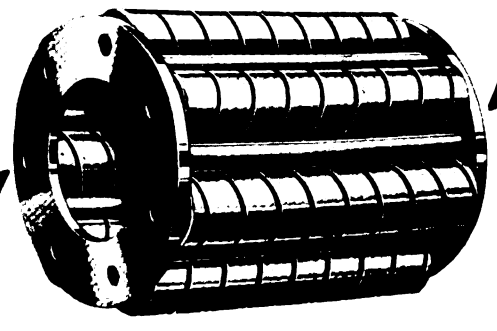
Steubing Hyatt equipped lift truck.



Cowan Hyatt equipped lift truck.



Lewis-Shepard Hyatt equipped lift truck.



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Industry Illustrated

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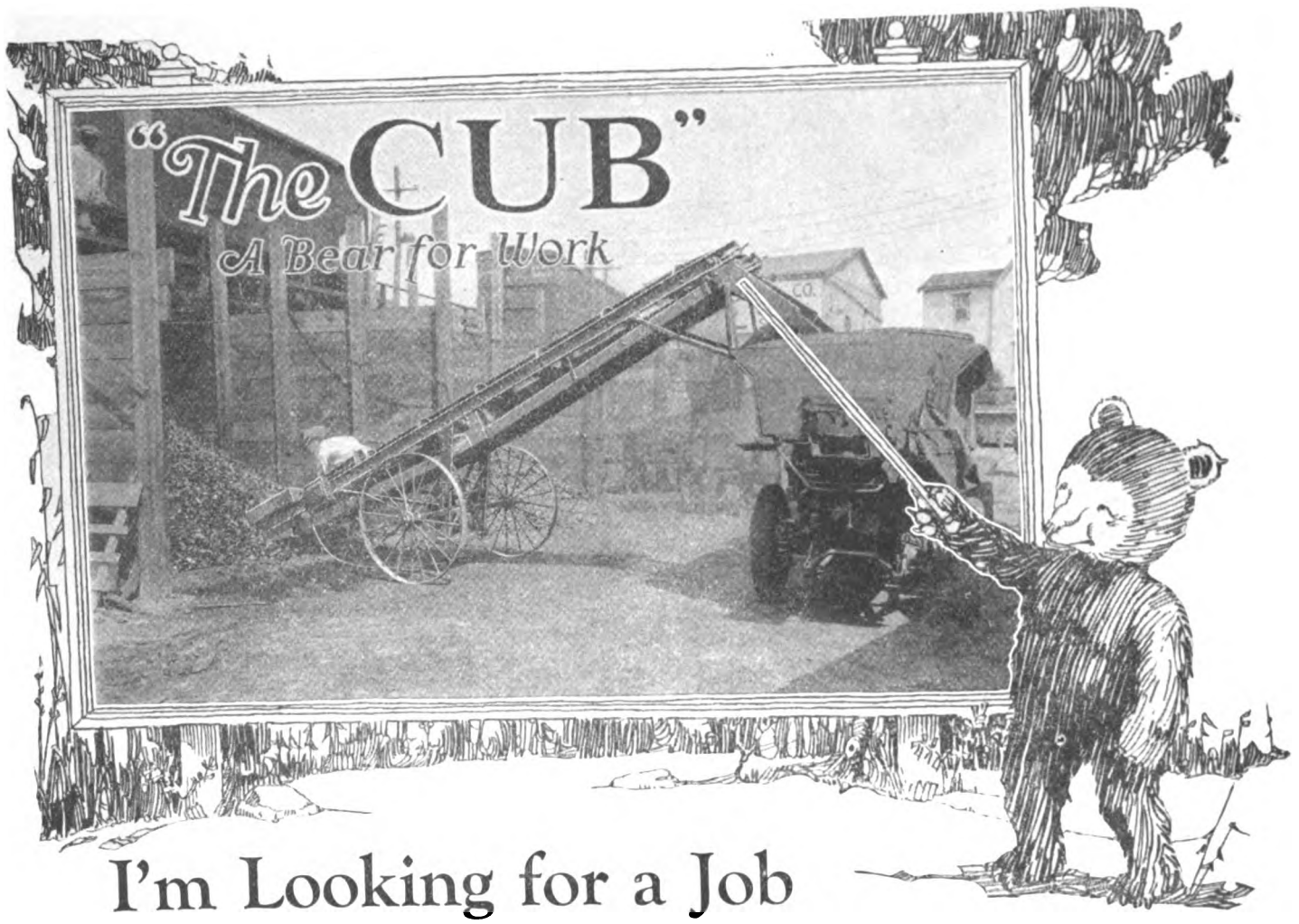
HARVEY CONOVER, JR.
Vice President

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The illustration on this page shows pulverized-coal-fired boilers in the Lakeside Plant of the Milwaukee Electric Railway and Light Company.

We are always glad to supply, on request, information regarding any illustrations which appear in INDUSTRY ILLUSTRATED

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I'm Looking for a Job

—and I'm a "bear for work." My full name is "Link-Belt Portable Conveyor," but they call me "The Cub" for short.

Just show me the pile of coal, sand, gravel or other loose material that you want to load on to trucks or cars and I'll set a new record for fast work.

I'll work 8, 12 or 24 hours a day if you want me to. I never go on strike, never take a day off nor ask for more pay. In fact my price is less than it used to be (see note).

If you want to know more about me and my big brothers ask for booklet on "Link-Belt Portable Loaders".

1294

NOTE: Owing to the greatly increased demand for a small portable conveyor we have been able to bring production to a point that permits of lower prices. You can buy "The Cub" now for $585, instead of $700. At this new price even the smallest coal yard, manufacturing plant, mill or factory, handling a small amount of material, can afford to use this mechanical loader. In fact you lose money by not having one.

LINK-BELT COMPANY, NICETOWN, PHILADELPHIA, PA.

Please send me your illustrated book of Link-Belt Loaders, showing all types, sizes and capacities.

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Address _____ Town _____ State _____



Industry Illustrated

LINK-BELT

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Can you employ portable moving belts instead of shovel gang, lift truck or wheelbarrow men?

Portable moving belts replace common labor

EVEN in Japan, where shovel labor is cheap, Barber-Greene mechanical shovels in the form of Bucket Loaders are replacing the coolie. In the more remote regions of Canada, where labor for road-building is difficult to get and keep, Barber-Greene equipment is used to keep down the size of construction crews. Here in America, where Barber-Greenes were first made and employed, their use is becoming increasingly general. They lessen the need for common labor and decrease the cost of handling materials. Barber-Greene conveyers are being used for handling power plant coal, for loading breakables, for reclaiming scrap, for handling bags, for unloading coal or other material from cars, for providing moving inspection tables, and for many other purposes. The high cost of material handling labor makes their use especially profitable now. Send for our catalog V and additional application data.

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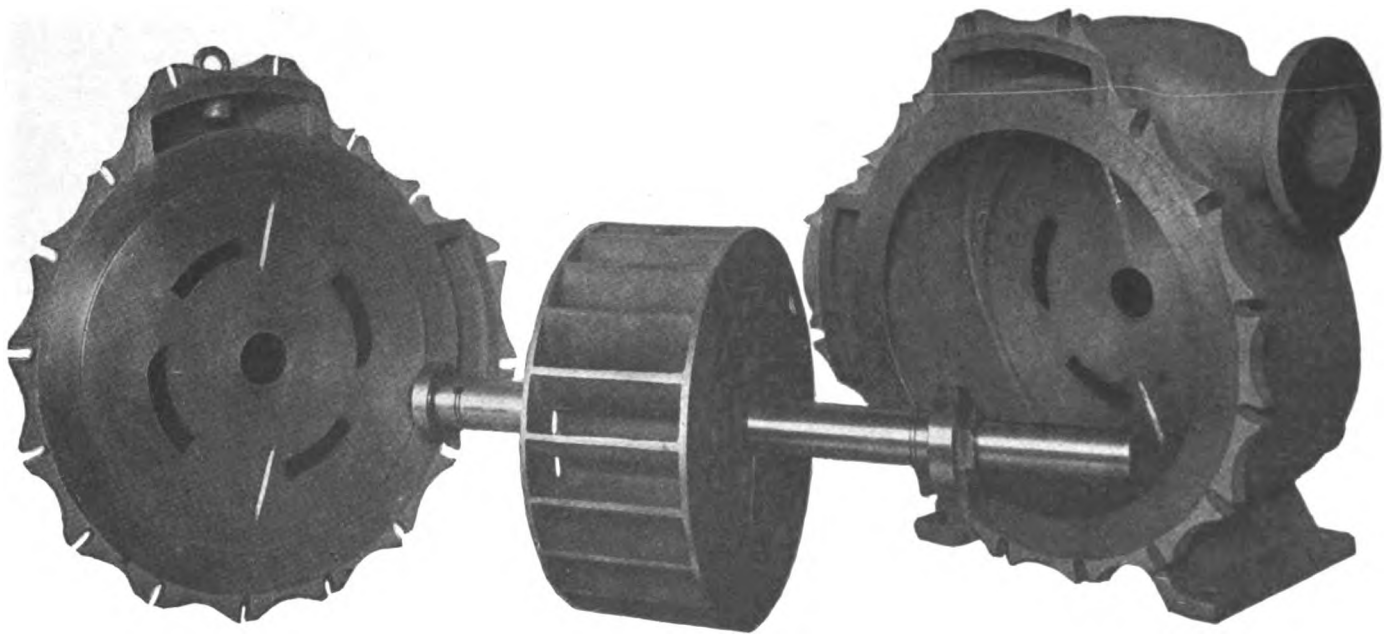
Portable Belt Conveyors

Self Feeding Bucket Loaders

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NASH HYTOR

THE ECONOMICAL AIR COMPRESSOR AND VACUUM PUMP



ALL THE PARTS OF THE HYTOR

THE HYTOR COMPRESSOR is valveless, has no gears, loose moving or reciprocating parts, no piston packing to renew, no cylinders to lubricate, and no bearing adjustments to make.

The rotor, the only moving part, is cast in one piece, the blades being rigidly reinforced by shrouds. The rotor is mounted on a short, stiff shaft supported at each end by the highest grade annular ball bearings mounted outside of the casing.

As the peripheral clearance is large, there is no possibility of the ends of the rotor blades coming in contact with the casing.

The original high efficiency is maintained indefinitely in continuous service.

The air is thoroughly washed during compression and contains no oil.

Hytor compressors occupy very much less floor space and are much lighter in weight than reciprocating compressors.

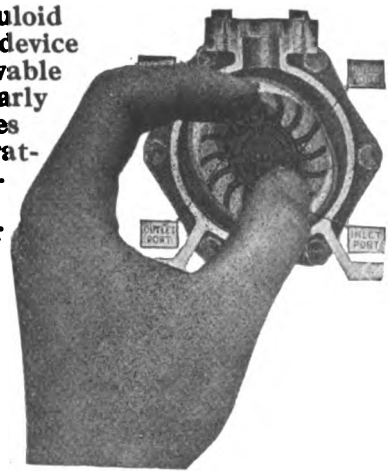
They run without vibration.

The cost of installation is greatly reduced as no expensive foundations are necessary.

No expert attendance is required as there are no adjustments to make. The cost of upkeep is negligible.

Hytor compressors are quiet in operation.

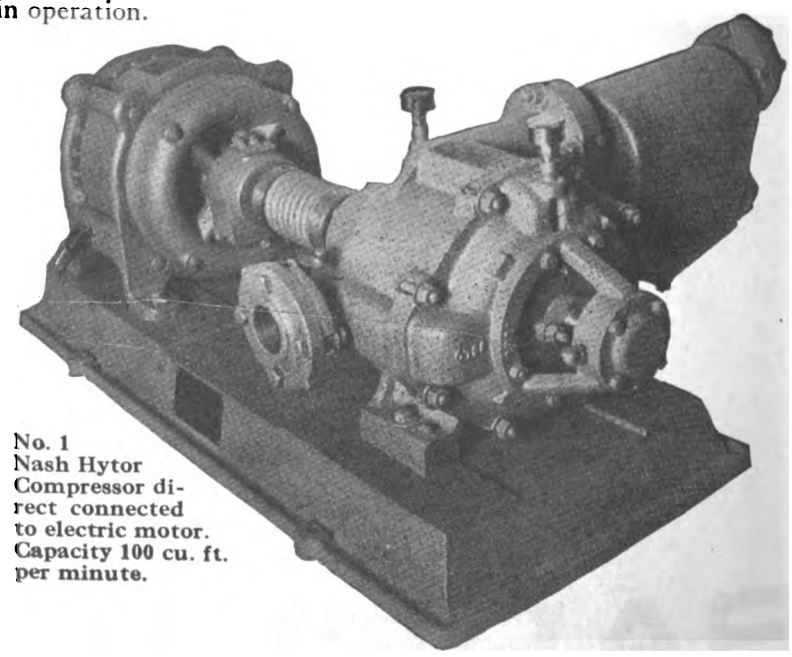
This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.



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It is common practice in handling mildly acid vapors to re-circulate thru the pump an alkaline solution for the protection of the cast iron structure of the pump. In handling chlorine gas, concentrated sulphuric acid is re-circulated.

Air handled by the Hytor is delivered absolutely clean and free from dust or oil; a great advantage in the agitation of good products or in absorption processes where diffusion of air is accomplished by blowing thru filters, porous blankets or small orifices.



No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

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EDITORIAL

The Key to Progress

IN the opening chapter of his great work, *The Wealth of Nations,* Adam Smith shows how manufacturing productivity was multiplied by the division of labor. He cites the case of the manufacture of pins; pointing out that in a small factory employing ten men, each man doing only one or two of some eighteen distinct operations, the production is upward of 48,000 pins a day or 4,800 per man—whereas, were each of the ten men, without specialized training, to perform all the operations, they probably could not produce twenty pins each per day.

Adam Smith's book was first published in the year 1776, the same year in which this nation was born. An odd coincidence, because America, more than any other country, is responsible for the mechanicalization—the replacing of men by machinery, the use of steam and water and electric power—which (to use the illustration he cites) today accounts for a production of almost 150,000 pins a day for each man employed in the industry.

Most of us in this busy hive that constitutes American industry are too busy to pause and consider; we are so occupied with the immediate present that we have scant time to review the past or to speculate intelligently concerning the future. Yet it would be interesting and instructive if some present-day Adam Smith would lay before us as well-reasoned an analysis of the complexities of modern civilization.

The "average" man of one-hundred-and-fifty years ago lived and worked and died within a circle of perhaps twenty-five miles in diameter; he learned of events a few hundred miles away only after the lapse of days and sometimes weeks; news from overseas reached him months later, by sailing vessel, news from overland by post-chaise or a-horseback; and these, or his own feet, furnished his only means of travel.

We have always with us the professional reformer, who would make the worker's life a Utopian paradise overnight; we have the agitator, who would bring about the six-hour day by means of a "proletarian" revolution; we have the demagogue, who performs eternal lip-service for the common people. These are the ones who, in all the ages, and in various guises, have held the spotlight and monopolized the prayers and hurrahs of the unthinking.

But all the while without any blare of trumpets, a steady, purposeful evolution has been taking place in civilization. And it is industry—not the professional reformer—which has transformed the worker's life; it is industry—not the radical agitator—which has made the eight-hour day a fact, and the six-hour day a possibility of the not-too-remote future; it is industry—not the demagogue—which has, through multiplying man's productive power, bettered the lot and broadened the vision of the common man.

Doubtless the reformer and the agitator and the demagogue will continue to hold the attention of vast sections of humankind, for the human mass-mind works that way. And doubtless industrial evolution will continue on its slow, steady progress; for that is the way real progress has always been achieved.

Bringing together men with the will to work and men with the vision and capacity to direct, and calling upon science and inventive genius to supply the machines and the power—that is what multiplies man's productive capacity; that is what makes possible shorter hours and lightened labor, more earning power and greater recreation, better education and consequent higher standards. And that, in sum and substance, is industry.

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From Scrap and Pig to Steel Castings

A Non-Stop Trip Through a Modern Steel Casting Plant

By G. P. BLACKISTON

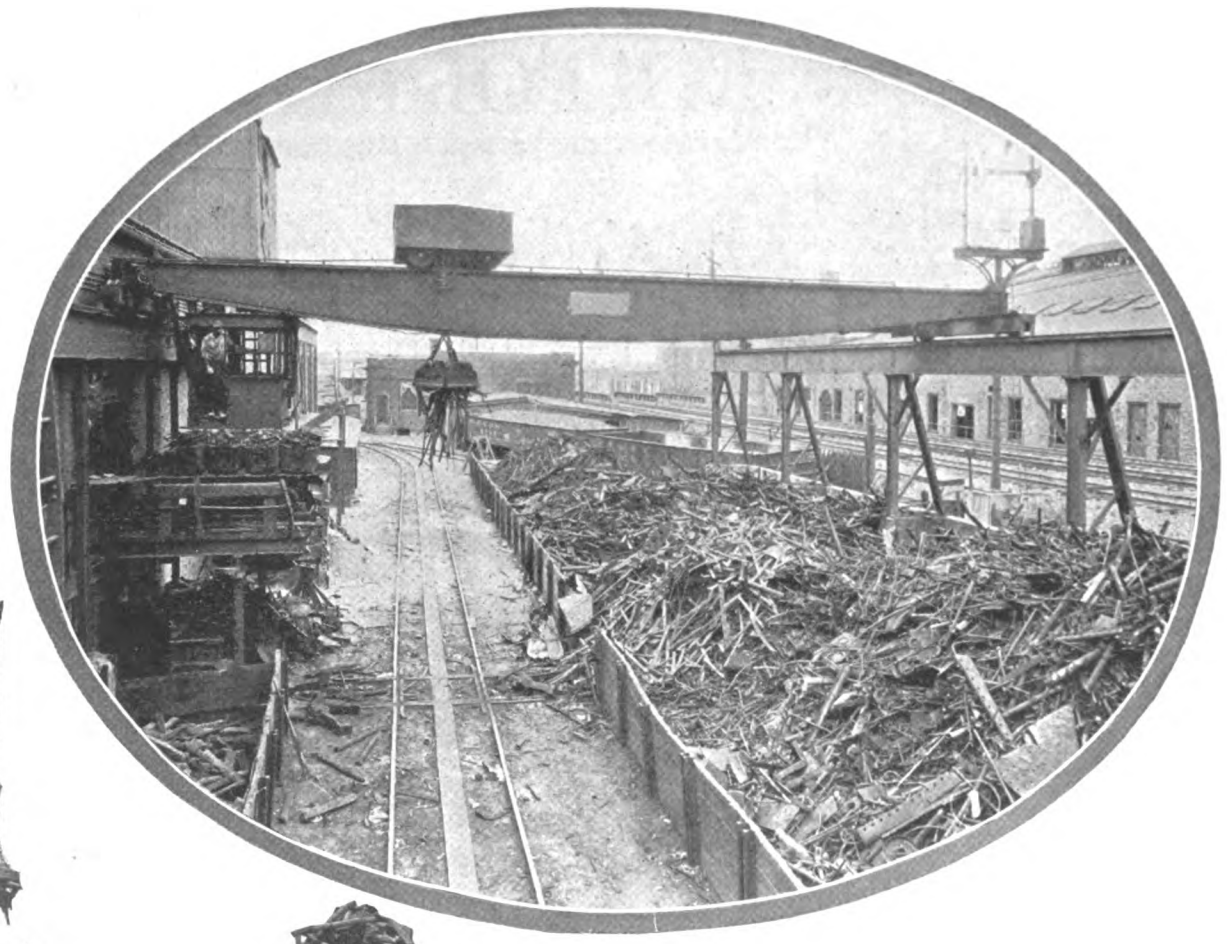


Fig. 1. Here is piled, in a systematic manner, each grade of scrap in its respective bin; to be picked up, as needed by the giant magnet.

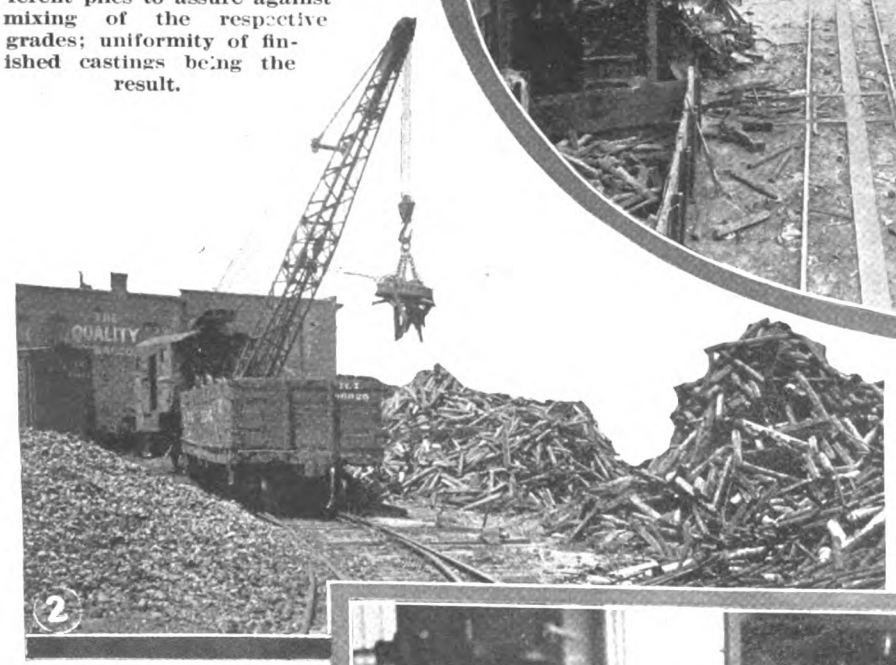


Fig. 2. As the pig iron is unloaded, it too is piled carefully in different piles to assure against mixing of the respective grades; uniformity of finished castings being the result.



Fig. 3. Pattern-making. Here the image of the article to be made is reproduced in wood. The exactness of the pattern determines the exactness of the finished casting; proper allowance being made for expansion and contraction of the metal. Pattern-making is an art within itself.



Fig. 4. Checking patterns with blue prints, making record of patterns, loose pieces, core boxes, etc., to assure a perfect casting. Careful attention to such details is important.

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Fig. 5. One-half of the pattern is here shown on the plate; the flask or container being lowered around it in order to permit sand to be packed around the pattern. When this is done, the flask will be turned upside-down, the bottom plate (which holds the pattern in place) will be removed, and the pattern carefully pulled out; leaving an exact reproduction of the pattern in the sand.



Fig. 6. Ramming one section of a mould. The iron outside form is known as a flask; its mission being merely to form a wall or container to hold the sand. Each part or section of a mould is so made and then these sections are placed together, making one complete mould for reproducing the object wanted.



Fig. 7. Showing how the pattern is carefully drawn from the sand, leaving an exact reproduction of the pattern in the sand. This vacancy will eventually be filled with molten metal.



Fig. 8. Setting a core. The object which these men are lowering in place is a sand form, or core. When the metal is poured into this mould, it fills up everything except where there is an obstacle, such as the core. When the metal becomes solidified, the sand core is removed, leaving the desired hollow or hole.



Fig. 9. Here is shown a finished section of a mould; the pattern having been drawn from the sand, leaving its shape and impression therein. The operator shown is drying the sand surface, or skin.



Fig. 10. Closing a mould. Placing one flask, containing one section of the mould, on top of another; thereby making or building up complete the shape desired for the finished casting. The cores (which will, in the finished casting, be the holes) are very plainly seen.

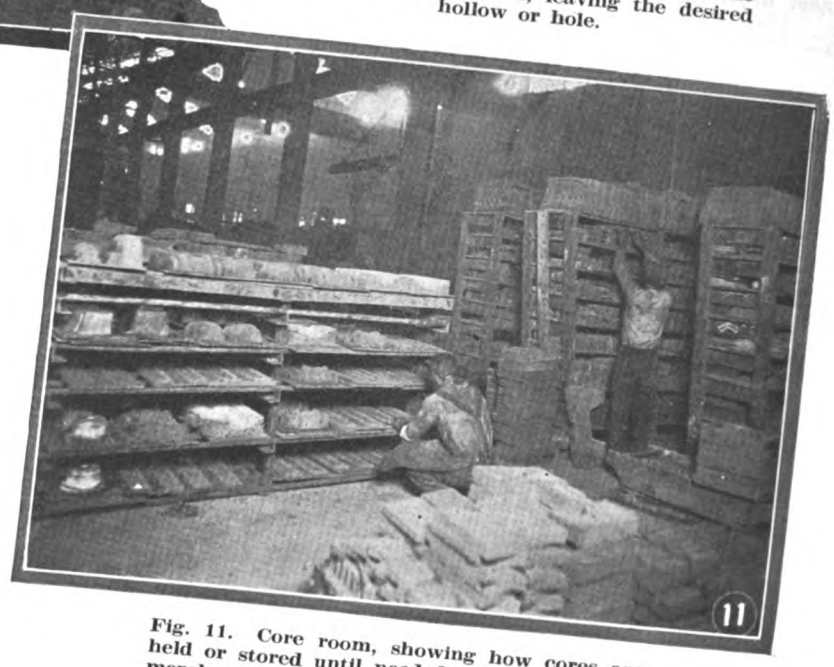


Fig. 11. Core room, showing how cores are held or stored until needed. These cores are merely well-baked or hardened forms of sand properly compounded and shaped to the size of the holes or hollows that will be wanted in the finished castings.

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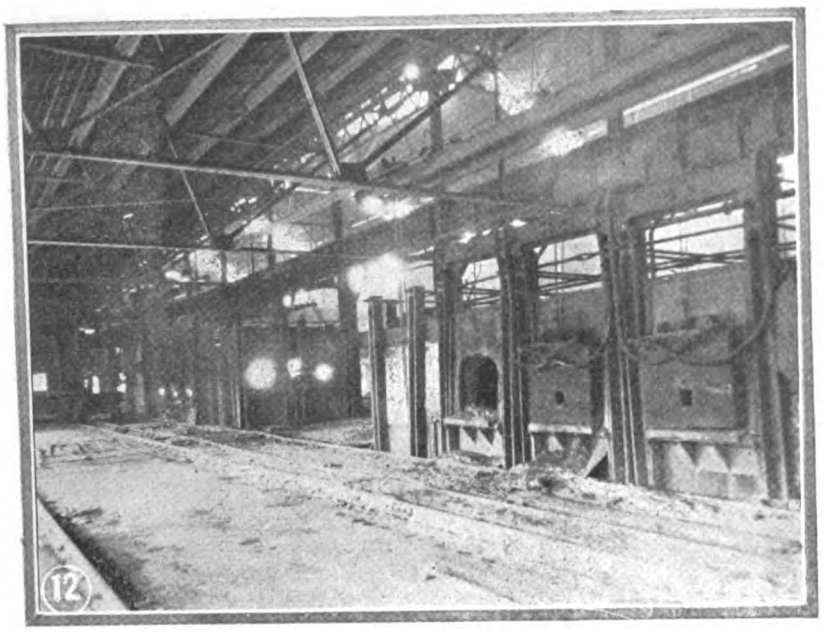
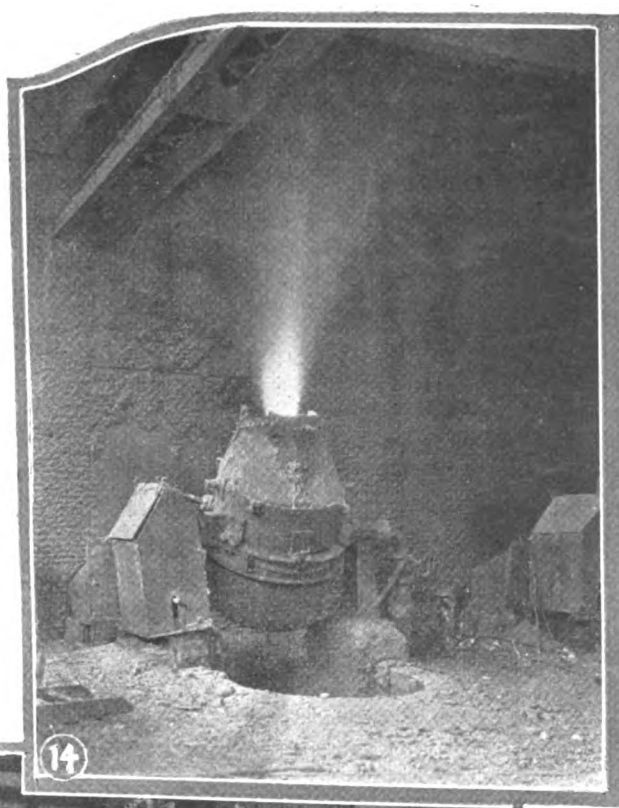


Fig. 12. The open hearth furnace. This shows the charging side of two 20-ton open hearth furnaces. When the furnace is charged, the three doors are lifted as required, and the pig iron, scrap and other ingredients are dumped or thrown into the furnaces through these doors. It requires about four to six hours to melt a heat.



Fig. 13. Tapping side of an open hearth furnace. When the molten metal inside is ready, of the proper analysis, a hole is forced open in the furnace at the spout, and the molten metal permitted to flow into a ladle. The ladle is then lifted by a crane and carried to the respective moulds and the necessary quantity of metal allowed to flow from the controlled hole in the bottom of the ladle, into the hole in the sand mould.

Fig. 14. This is a converter in the midst of "blowing" a heat. The furnace or converter is pear-shaped and is held on two arms or trunions. When it is being charged with the molten metal from a cupola, it is permitted to lie on its side, the mouth being up. The instant it is charged, a tremendous blast enters the bottom, the vessel is turned up, and the chemical reaction begins, as shown in the illustration. When ready, the contents are poured into a ladle and handled as in the open hearth process.



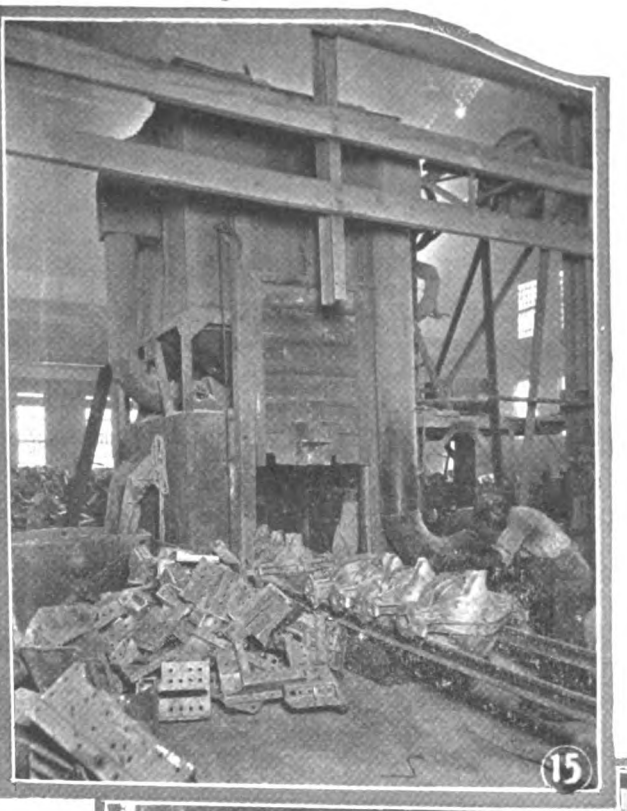


Fig. 15. Sand blasting. Here the castings are placed in a large container and subjected to a severe blast of fine sand from all sides. This cleans and removes all scale, or hardened sand, oxide, etc., which may have adhered to the surface of the casting.

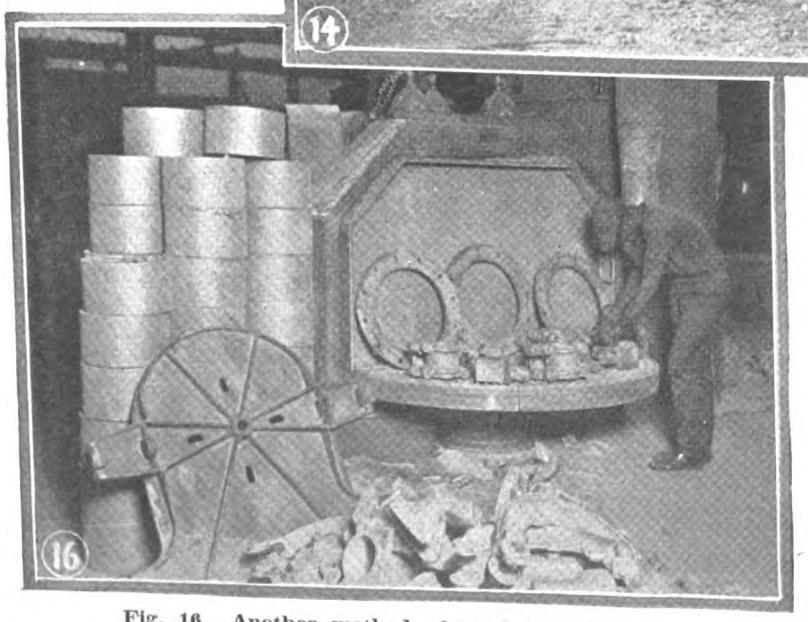


Fig. 16. Another method of sand blasting. It consists of a large turn table, one-half being inside the machine where the sand blasting is taking place, while the half that is outside is being unloaded and reloaded. It allows a continuous operation.



Fig. 17. Weighing a finished casting. Steel castings are priced by weight and fineness of quality; the cost being influenced, of course, by the intricacy of the casting. This latter is apparent when we take into consideration the making of patterns and moulds.

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He Chased the Rainbow—Caught It—and Put It to Work

Frederic Eugene Ives, Prolific Inventor—Father of Half-Tone Engraving

BY ERNEST H. ROWE

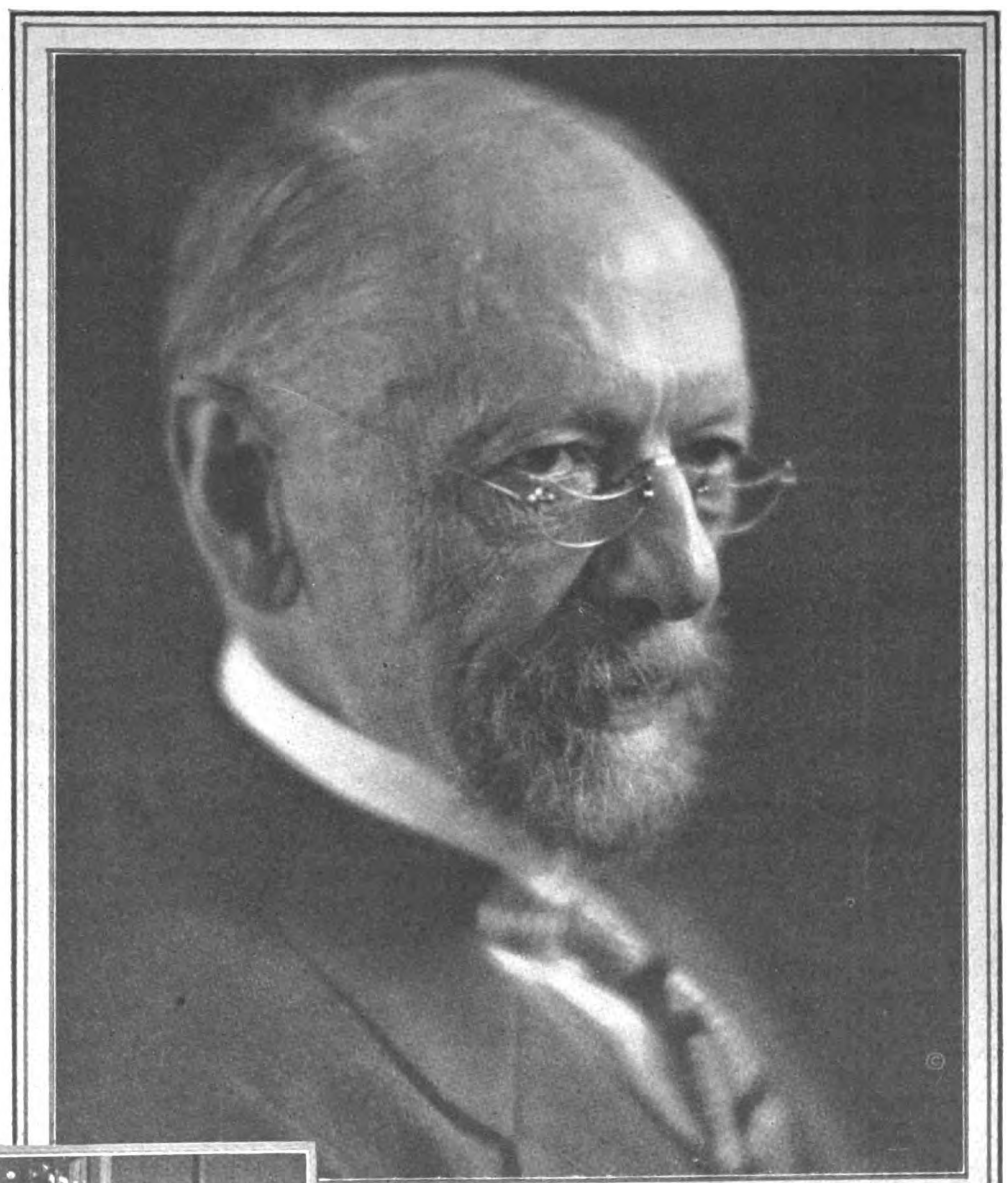
THE sixth decade of the nineteenth century seems to have been exceptionally active in attempts to take the pictures made by the still new art of photography and reproduce them by some process which could be used on the printing press. Nature took a hand in the activity by bringing into the world, on the seventeenth day of the second month of the sixth year of that decade, a man child who, by the time he was twenty-two years of age, solved that problem. She selected the old New England town of Litchfield, Connecticut, and the old New England family of Ives for his birthplace and parentage. They christened him Frederick Eugene. Several of his active years as an inventor were spent in London, England, and in the New Jersey towns opposite uptown New York, but now he lives in Philadelphia. Perhaps he moved there so it would be more convenient to step into the Franklin Institute for the medals it awards him every now and then for his inventions and discoveries in optics: color photography, motion pictures, lenses and apparatus of great variety. Several other scientific societies have bestowed their medals or memberships upon him, and the United States Government alone has granted him nearly a hundred patients to date.

But one thing he lacks—a college degree. Because he never went to college. So, he isn't "educated." But most certainly he is learned. Formal "education" is not to be despised, by any means, but its absence does not debar anybody from gaining its equivalent if he but will.

Today's school boys are fooling with radio. Young Ives was just the same kind of a boy, who tinkered with what was then the scientific curiosity, the "little black box" that somehow took pictures. He had his "home-made set" fashioned of a cigar box with spectacle lenses. Wouldn't that camera be a treasure for some museum, to be gazed upon in wonder by present-day and future press-the-button amateurs who often do not even know the names of the materials with which they so easily snap-shot anything they can see and want to "take" so they can see it again at pleasure?

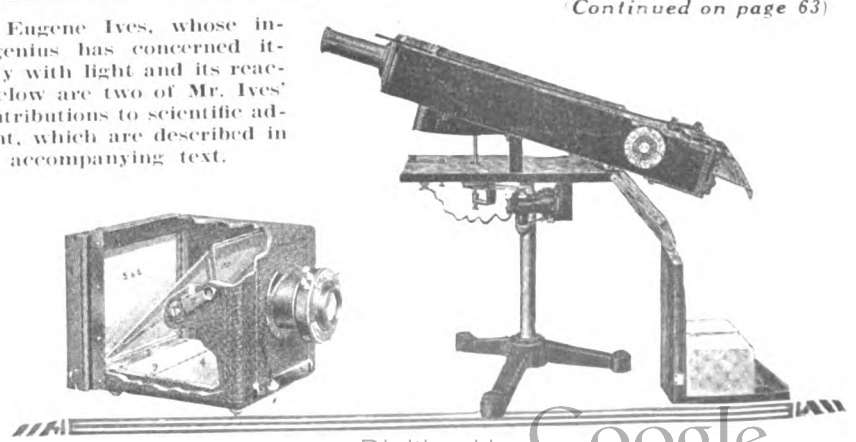
Litchfield is a town with atmosphere: Colonial, Revolutionary, historical, learned, religious, American, Yankee atmosphere. It is not hard to imagine that a childhood spent there would be almost the equivalent of a college education. In the struggles which attended the birth and early development of this nation, Litchfield was no mean city. Its impress upon our institutions is not measured by its pres-

(Continued on page 63)





The inventor, amid familiar surroundings in his laboratory.



Frederic Eugene Ives, whose inventive genius has concerned itself chiefly with light and its reactions. Below are two of Mr. Ives' many contributions to scientific advancement, which are described in the accompanying text.

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The Elimination of Re-Handling

How the Lift-Truck and Skid System Cuts Handling Costs

By Matthew W. Potts

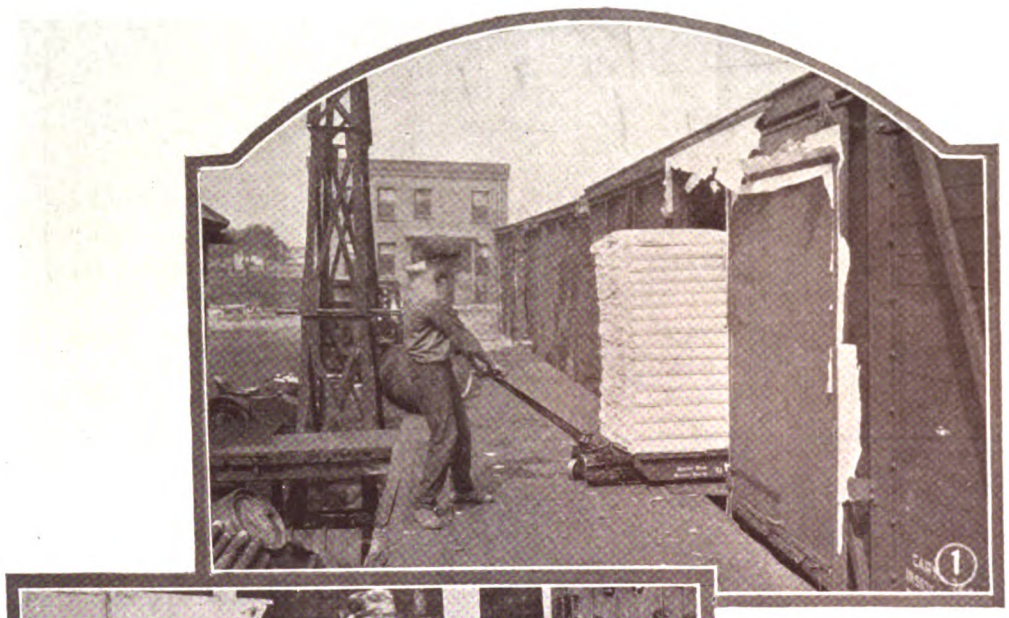


Fig. 1. Car unloading with skids and lift trucks is simple. One truck will handle a number of skids without delay, waiting for loading and unloading.

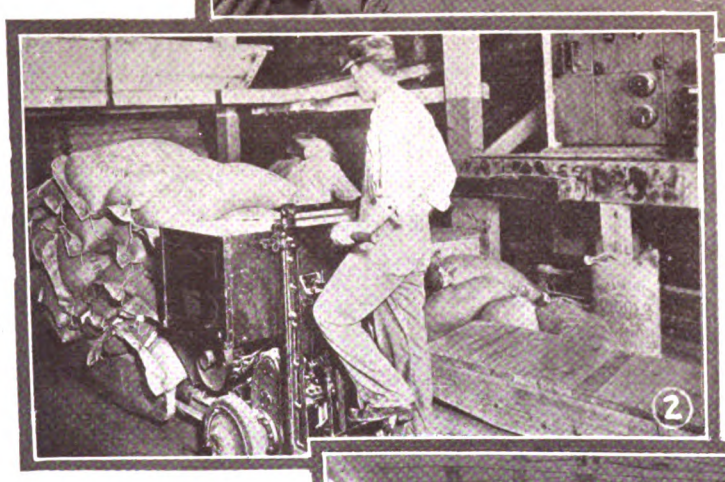


Fig. 2. The electric lift truck picks up the loaded skid within the plant. Empty skid shown to the right will then be loaded with bags.



Fig. 3. Without re-handling, the load shown in Figure 2, is transported directly into the car for stowing.

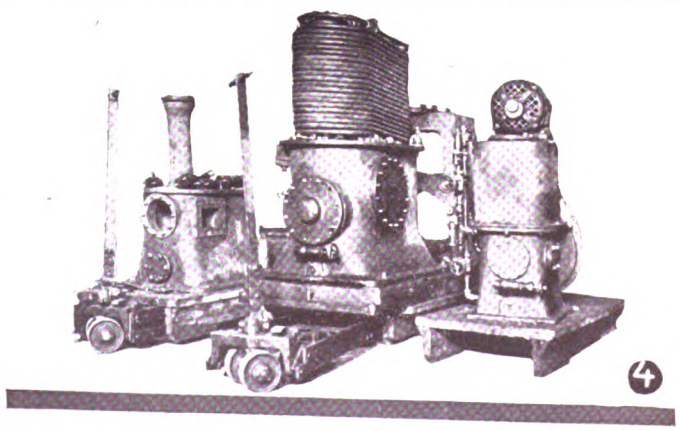


Fig. 4. Heavy machinery assembled on skids can be quickly moved from place to place by hand trucks.

ONE of the commonest jobs in any manufacturing plant is that of a trucker. The commonest of common labor seems fitted for this work. The principal requirement is brawn, and plenty of it. No attention is paid to what the men have from the neck up; so the movement of materials about the plant, and from one department to another is delayed, and the work of skilled workmen hampered, with a subsequent lessening of production. Desperate measures have been resorted to by some manufacturers, the number of truckers increased in some instances, so that the men are actually in one another's way. The result of such practices is to cut down productivity still more.

There is one way out of the difficulty; to use mechanical equipment for moving goods. One of the most versatile systems for this purpose is the elevating platform truck with skids. Piling and re-piling, handling and re-handling is the cause of waste and expense in the old style trucking. It takes time and labor to set up and tear down a load, and with the ordinary type of platform hand truck, and platform power-driven truck, this setting up and tearing down is absolutely necessary. Moreover, this piling and re-piling is done not once, but several times in most factories, from

Fig. 5. Tanneries are severe on all classes of equipment, due to acid conditions. The use of lift trucks and skids materially reduces truck maintenance expense.



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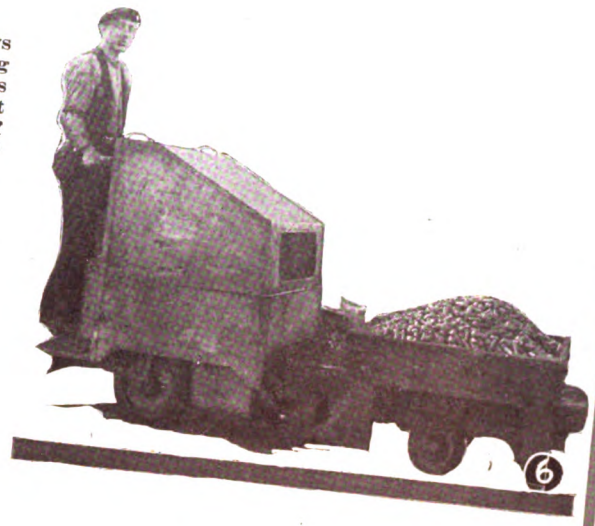


Fig. 6. This illustration shows a gasoline lift truck performing practically the same work as the electric storage battery lift truck in Fig. 7. The type of truck to be used depends largely on operating conditions.

the receipt of the raw materials to the shipment of finished goods.

Elevating hand trucks and elevating power trucks are fundamentally self-loading devices, and by allowing the loads to remain on the skids, eliminate many loading and unloading operations. The lift trucks and their skid accessories have probably caused the most radical changes in plant operating methods, and the greatest economies in non-productive labor costs, than any other type of mechanical handling equipment.

Manufacturing concerns that have installed this type of equipment report large money savings in direct labor costs. The operating superintendent of one plant reported that the use of electric elevating platforms and skids had proved so beneficial that they were able to show that each electric truck reduced direct labor costs $800 per month, over old hand methods.

Another concern handling large rolls of paper has been able to demonstrate that their use of lift trucks and platform skids has effected a savings in labor costs of $21,000 per year. These are only two of the many installations that are now operating successfully in all types of industries, but they show the enormous reductions that can be made in costs by using mechanical equip-



Fig. 7. Machine shops have found the lift truck system advantageous. If these skids were equipped with racks for holding material, they would no doubt be more efficient. The construction of the skid is sturdy.

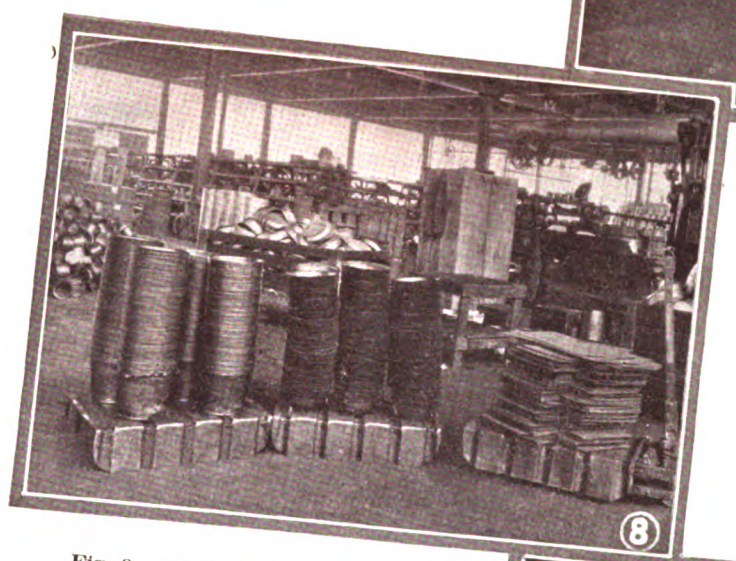


Fig. 8. Pressed steel skids are becoming more common, due to their practical indestructibility.



Fig. 9. The handling and re-handling of sheet tin is difficult and dangerous. Skids and lift trucks permit one handling from car unloading to point of consumption. This shows the stock room in a large can company.



Fig. 10. The use of skids is not limited to any one industry, and can be used just as advantageously on produce, as on machine parts.



Fig. 11. Storing materials in the stock room on skids greatly reduces warehouse labor and facilitates quick movement of materials. This is the warehouse of a large electric manufacturing company.

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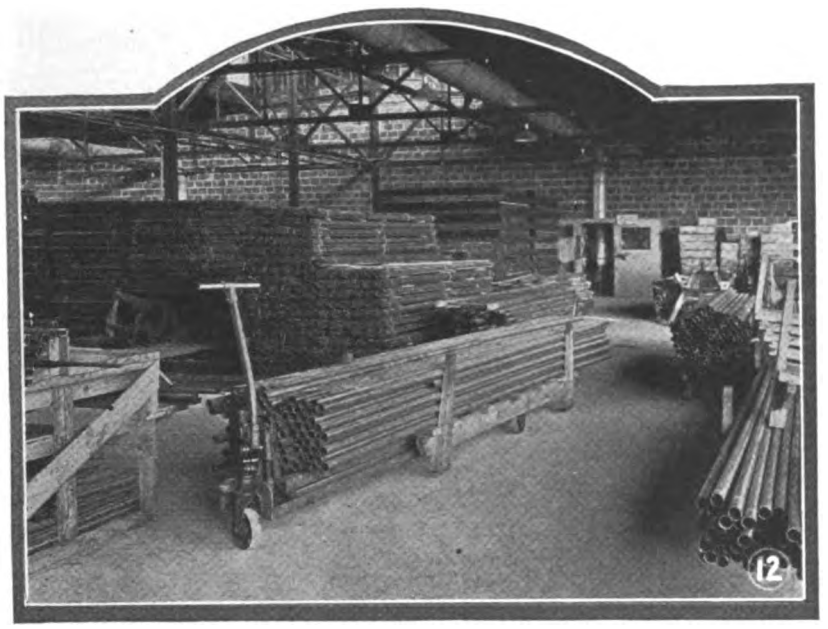


Fig. 12. Hand lift trucks are not limited to the handling of short loads. This truck is 9 feet long, and the pipe handled is about 14 feet long. The installation has proven successful under operating conditions.

ment, instead of common labor, for handling materials.

Another advantage is that, at present, common labor is not available, and the shortage is becoming more acute day by day. We first look to the southern states as a place where labor can be easily obtained, but even the industries located in such states as Alabama, Georgia, Mississippi, etc., are now turning to mechanical equipment, because it is impossible to secure the common labor to do the menial handling jobs.

Trucks that will operate with skids now fall into three classes, namely; hand operating, electrically operating and gasoline operating.

The hand truck was the first type used. Its operation is simple. It is first pushed under a loaded skid, and the handle pulled downward, (figure 19) the lifting bars raise the skid and load from the floor. When elevated, these bars assume a fixed position, and remain rigidly locked in position until they are released by the operator. To lower the load, the operator steps on the lock pedal, and releases the catch. A powerful hydraulic check eases the load smoothly and

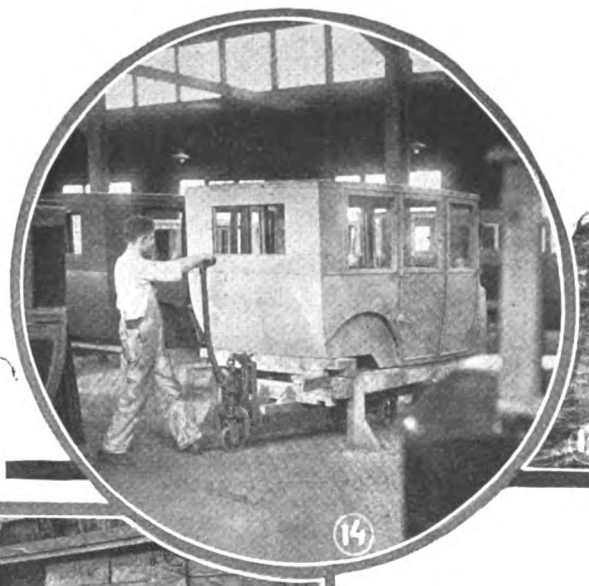


Fig. 14. Note how automobile bodies are handled by building a special wooden super-structure on the hand truck lifting bars. The bodies can be set on permanent bases, as shown, or movable bases if desired. The handling is safe and easy.



Fig. 13. While elevating hand trucks are not recommended for hauls over rough dirt roads, they are occasionally used under such conditions. This illustration also shows a cheap home-made dump body skid.

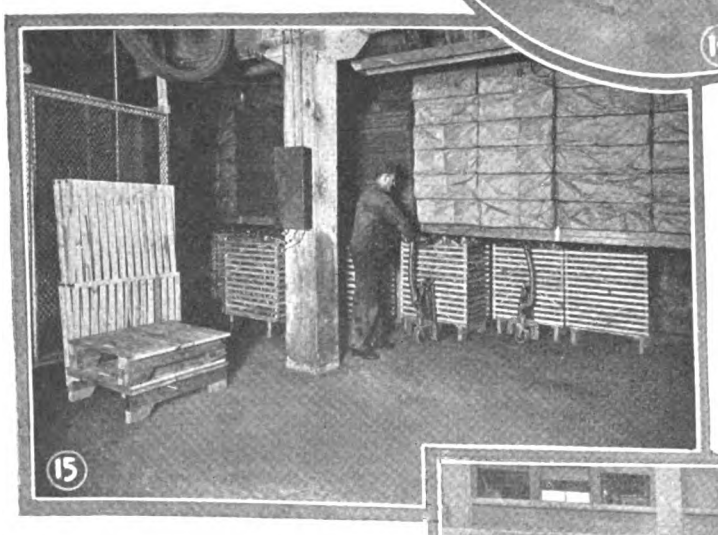


Fig. 15. This illustrates a collapsible rack for use with flat platform skids. The small parts are handled entirely in this way, and when the platforms are idle, they can be folded and put away in a small space as shown to the left.



Fig. 16. Special rack live skid for handling automobile rear axles. With any other method this would be a difficult and cumbersome part to handle.

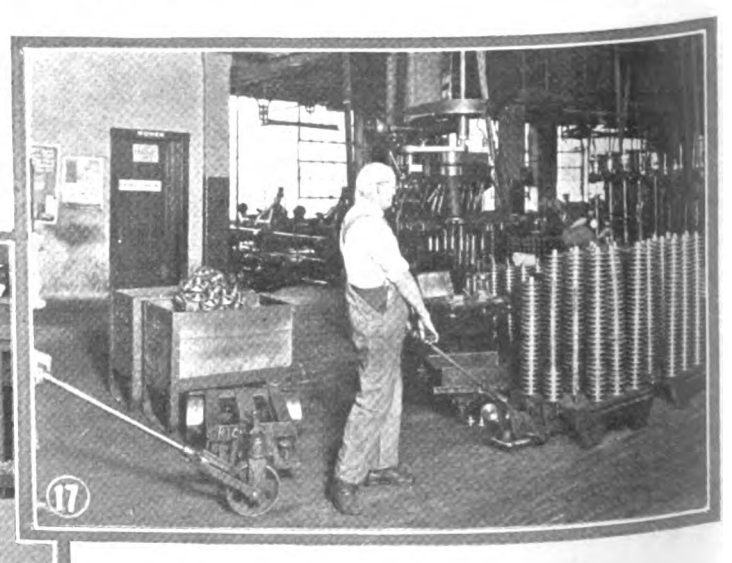


Fig. 17. Finished machine parts are easily damaged. By using skids equipped with spindles, these parts can be handled from operation to operation, and carried in stock, without being subject to damage by contact.

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evenly to the floor. The truck is then pulled out from under the skid, and can be used for another load.

The electric truck is somewhat similar in construction, but is provided with a platform on the lifting bars. This platform is elevated by means of electric power (fig. 7) and the entire load is propelled forward by means of a separate motor, the current for both motors being supplied from a storage battery which is mounted over the driving wheels. A similar truck is now being built with a gasoline motor as a power unit, the same motor operates the platform elevating mechanism. (Fig. 67)

The height of platform lift varies slightly in different makes of trucks, and this lift determines the height of the skid legs from the floor when they are being carried on the truck. If the surface on which the trucks operate is smooth, the clearance need not be so great, but when operating over rough floors, the clearance should be at the maximum, so that the legs will not catch and cause accidents.

In selecting the type of truck to be used, it is necessary to take into consideration the condition of floors, the length

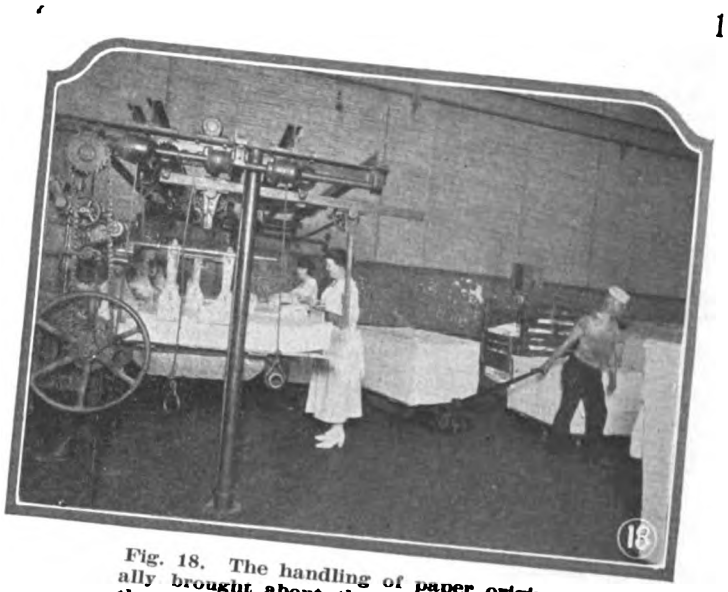


Fig. 18. The handling of paper originally brought about the development of the platform lift truck. Note how skids are supported for loading, direct from finishing machines. This illustration shows the start of the load.

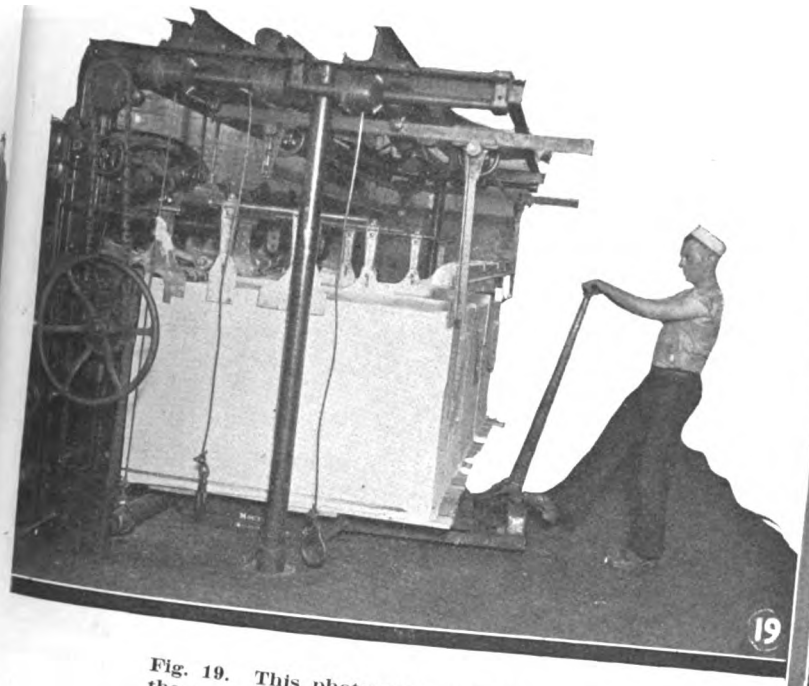


Fig. 19. This photograph was taken in the same location as the one previous, and shows skids completely loaded, and method of removing same.

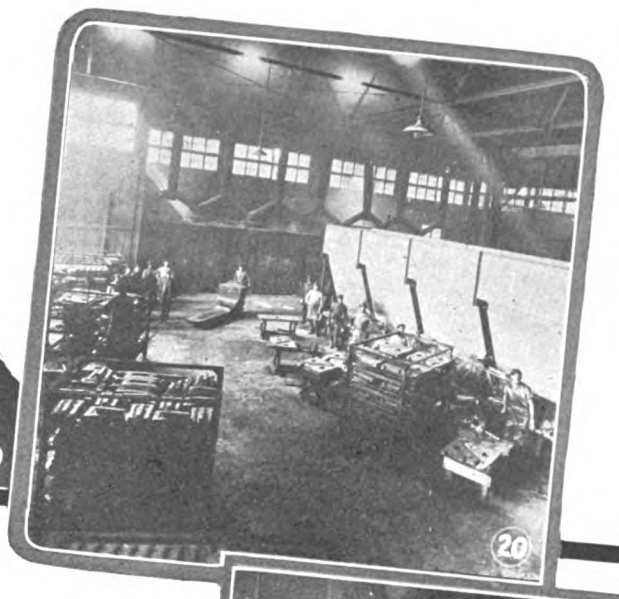


Fig. 20. Cores are fragile, and must be handled carefully. This shows skid racks being loaded direct from core-maker's bench.

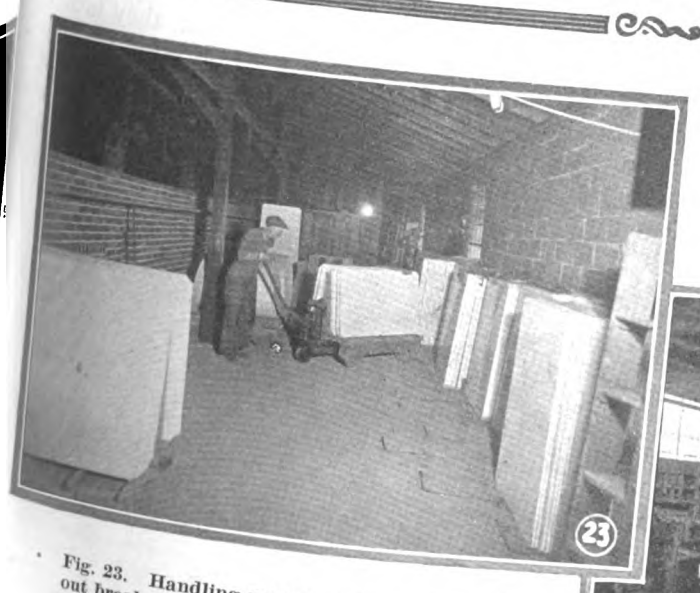


Fig. 23. Handling marble slabs without breakage is difficult, but skids and lift trucks have solved this problem. A wood rest up the center of the platform, and a simple board lock at the top, is all that is necessary. The circular slabs behind the truck operator, are handled in the same way.



Fig. 21. This illustration, taken in the same plant as the previous one, shows the method of placing rack loaded with cores in oven.



Fig. 22. Close view of core rack being transported by an electric storage battery truck to foundry.

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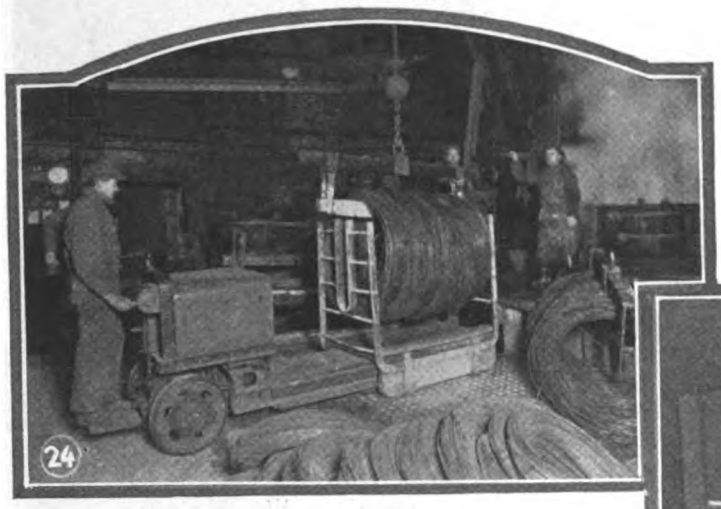


Fig. 24. To load this wire on hand trucks, and then unload it would be difficult. This special skid handles it with ease.

Fig. 25. Skids built with overhang platform operate well with standard portable elevators for piling.

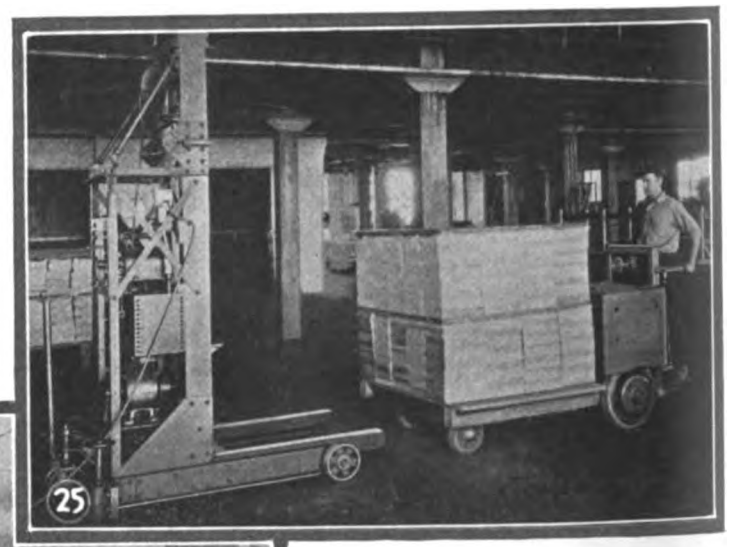


Fig. 26. Dump bodies mounted on skids have proven successful in handling refuse. The one shown is of standard design now being manufactured by several companies.





Fig. 27. The handling of small parts has caused many ingenious rack skids to be built. This shows a good method of handling and storing armatures.



Fig. 28. These skids were originally built so that they can be carried by hand. With a simple super-structure on the truck lifting arms, it is possible to move them with one man instead of two.

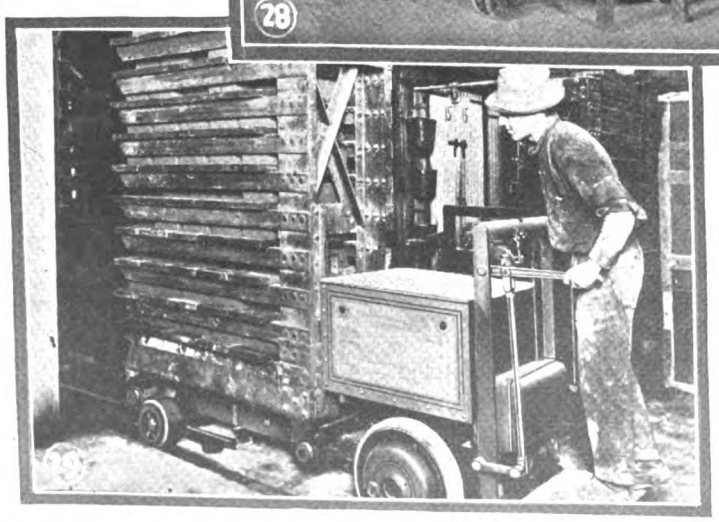


Fig. 29. The concrete block and brick industries are finding many uses for skids and lift trucks. This illustration shows 500 concrete bricks being carried directly from briquetting to bake oven, without re-handling.

of haul and the weight to be carried. The hand propelled type of truck is particularly recommended for movements or hauls up to 150 feet or less, and only over good floors. The electric or gasoline propelled truck is recommended for movements or hauls up to 3,000 feet or less, and over good floors. Although these types have been successfully operating over smooth dirt roads within the plant, they are not recommended for general yard work.

The most important part of the installation is the type of skid and particularly the construction of these skids. At first the construction consisted mainly of wooden timbers nailed together, with side legs sufficient to give the proper clearance for the truck platform. While these skids were cheap in first cost, they invariably carried a high maintenance expense, and frequently collapsed under heavy loads. Today, skids are built with wooden platforms and steel

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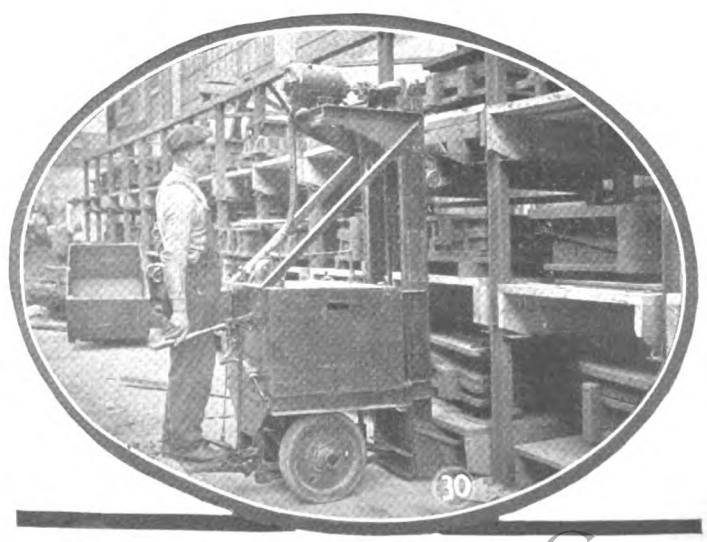


Fig. 30. The economies effected by the use of skids has brought about the use of racks, so that these skids can be tiered without resting on the load beneath. This shows a standard tiering machine placing a loaded skid in the upper tier of the rack.

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Cost Accounting in the Lumber Industry

How Coöperation Developed a Uniform System

BY O. H. KNEEN

ALMOST everyone knows that the "Evergreen State" of Washington, and its sister state, Oregon, produce one-quarter of the lumber annually cut in the United States. Only the initiated know, however, that one of the most notable examples of coöperation in the country's industrial history is also to be found in the western lumbering industry.

Near the end of the World War the lumbermen came to the brink of economic disaster. Cancelled orders, skidding prices, high wages, and a future beset with uncertainties, spelled receiverships for numbers of the less stable millmen on the Pacific Coast.

At this point came forward far-sighted operators composing the West Coast Lumbermen's Association. Early in 1918 they had started the design of a modern, practical and simple cost system, that elusive goal of all honest accountants. They aimed at a system which would be suitable for adoption, with minor adjustment, to any mill; inexpensive to operate; easily understood; yet giving the operator a clear bird's-eye-maple view, as it were, of his business.

The system was completed and a trial installation made early in 1919. So well has it filled the specifications that today over 100 mills have installed it completely, and another 150 use it as the groundwork of their accounts. It is in use in every considerable lumber-producing section of the United States, even to some extent in foreign countries. It stands as a monument to careful study and expert knowledge of lumber production.

One of the most interesting

(*Continued on page 43*)



Typical storm swept area on the Olympic Peninsula. Note the piles of fir, spruce and cedar. This is not all loss—development was expedited by the storm of 1921 and will save owners 20 years' taxes; modern methods will salvage much of this timber; the fir will lie 20 years without serious deterioration. It is interesting to note that the cedar is generally so well rooted that it withstood the wind which uprooted firs of eight centuries' growth.



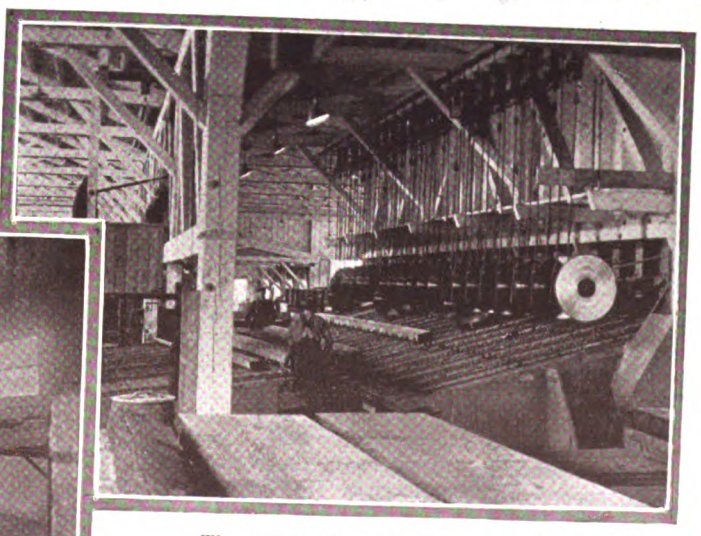
Typical old time ground-skid yarder and loader, requiring too much power to plow the earth every trip and also causing a great many accidents and loss of time. It has been replaced by the high-line method.



Logging in luxury—"Pullman" cars furnished by Snoqualmie Falls Lumber Company. The cars are 14 feet wide, 60 feet long, and have three "staterooms." At intervals the cars are thoroughly renovated by live steam.



Typical high-line methods in Washington Douglas fir logging. This method is faster, more economical, labor-saving and less liable to accident.



The gang cut-off—The sawyer in the cage at the left operates each of the 26 saws by manipulating a keyboard, lowering the required saw which squares ends, cuts out knots, or cuts into shorter pieces. Saws two feet apart and will take 52-foot material.

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Personnel Work That

BY N. J.

Personnel Manager, The Paraffine



Fig. 1. The upper view shows a demonstration class in first-aid learning by actual illustration the proper method of applying bandages.

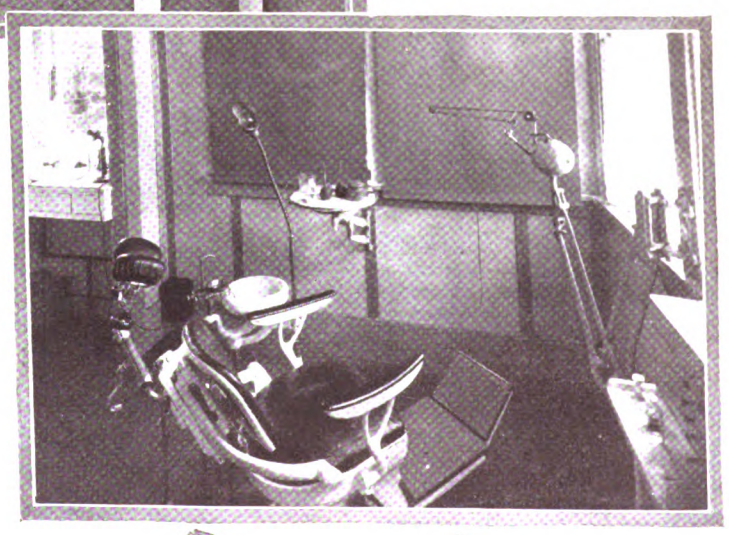


Fig. 2. Above is the well-equipped first-aid room in one of the plants typical of modern methods in safeguarding the worker.



Fig. 4. Dressing rooms, with wash-basins having hot and cold water, are an appreciated convenience.

Fig. 5. The club-house at the Emeryville plant; with a group on their way to lunch.



THE Paraffine Companies, Inc. derives its name from the Paraffine Paint Company—an organization founded over forty years ago to manufacture black (asphalt base) paints. With the development of business the company added new products to its line, such as felt-base roofings, felt-base floor covering, house paints, etc.

In 1917 The Paraffine Paint Company had grown so large and was making such a diversified line of products that a consolidation of numerous interests was effected, and today the firm, now known as the Paraffine Companies Inc., operates sixteen plants on the Pacific Coast making the following products:—Roofings, floor coverings, house paints and enamels, building paper, sheathing, paper boxboard and wallboard, solid and corrugated fibre containers and shipping cases and cartons of every description.

It has always been the desire of the management to practice enlightened human relationship with its workers. Close and friendly contact has always been maintained, but expansion, with this company as with others, has had the effect of making this contact more and more difficult. Realizing this growing condition and the necessity of correcting it along the more progressive scientific lines, a local man-

Fig. 3. At the left—Dentistry plays a very important part in general health; as we have only recently come to recognize.

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Pays Dividends

RICH

Companies, Inc., San Francisco, Cal.

agement research bureau was called in to make a labor audit and survey of one of the plants. It is upon the basis of this survey that the department of personnel was established in 1920 at which time there were some four hundred employees in the plant investigated.

The scope of the work now includes those features usually found in the personnel department of large eastern organizations, namely:

1. *Employment*:—The centralization of placement, transfer, promotion and discharge covering the plants of the central group, i. e., those situated in the San Francisco Bay District. Contact with the plants outside this group is maintained in a spirit of general coördination.

2. *Medical and Health Service and Education*:—The examination of all applicants before acceptance and subsequent periodic re-examination. This has effected a noticeable reduction of accident rates.

A dental service has been established for the employees. The cost of this feature is carried jointly by the company and the individual employees treated. Treatments are made on company time thereby effecting a big mutual saving.

Home visiting is carried on by a nurse in conjunction with

(*Continued on page 53*)



Fig. 6. A group of foremen at one of the mill plants, discussing knotty problems of manufacture.

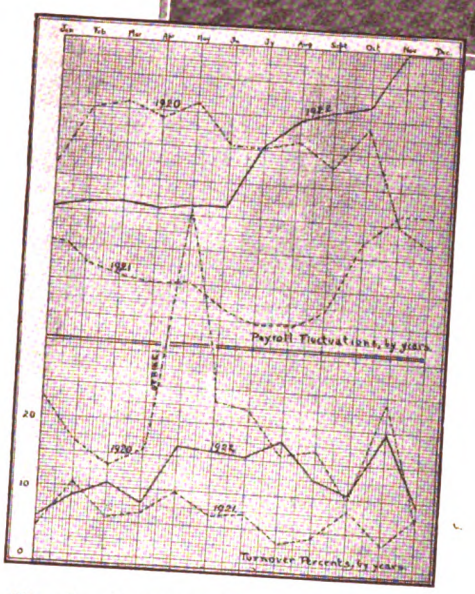


Fig. 7. A composite chart of labor turnover and number of employees for the years 1920, 1921 and 1922, in one of the central-group plants.

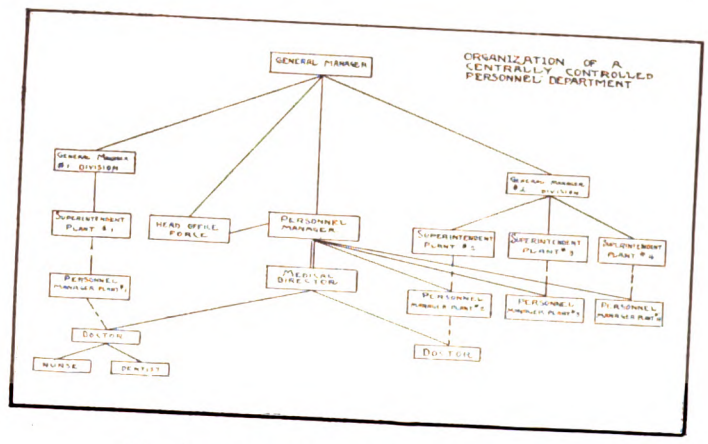


Fig. 8. A Chart of Organization of the centrally controlled personnel department which functions in all the plants.



Fig. 9. A regular meal is served daily —not cafeteria fashion—at the plants, and both quality and reasonable cost make this an important part of the work.

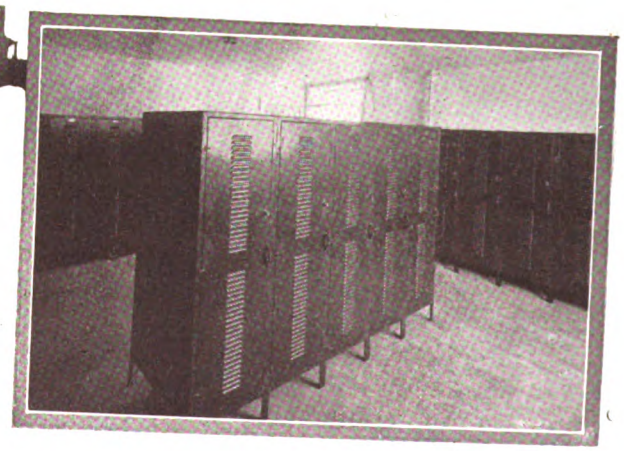


Fig. 10. Individual lockers are furnished, and sanitary conditions have had much to do with keeping up the morale and lessening turnover.

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Solving the "Impossible"

Special Equipment for Difficult Transportation Problems

By William Greaves

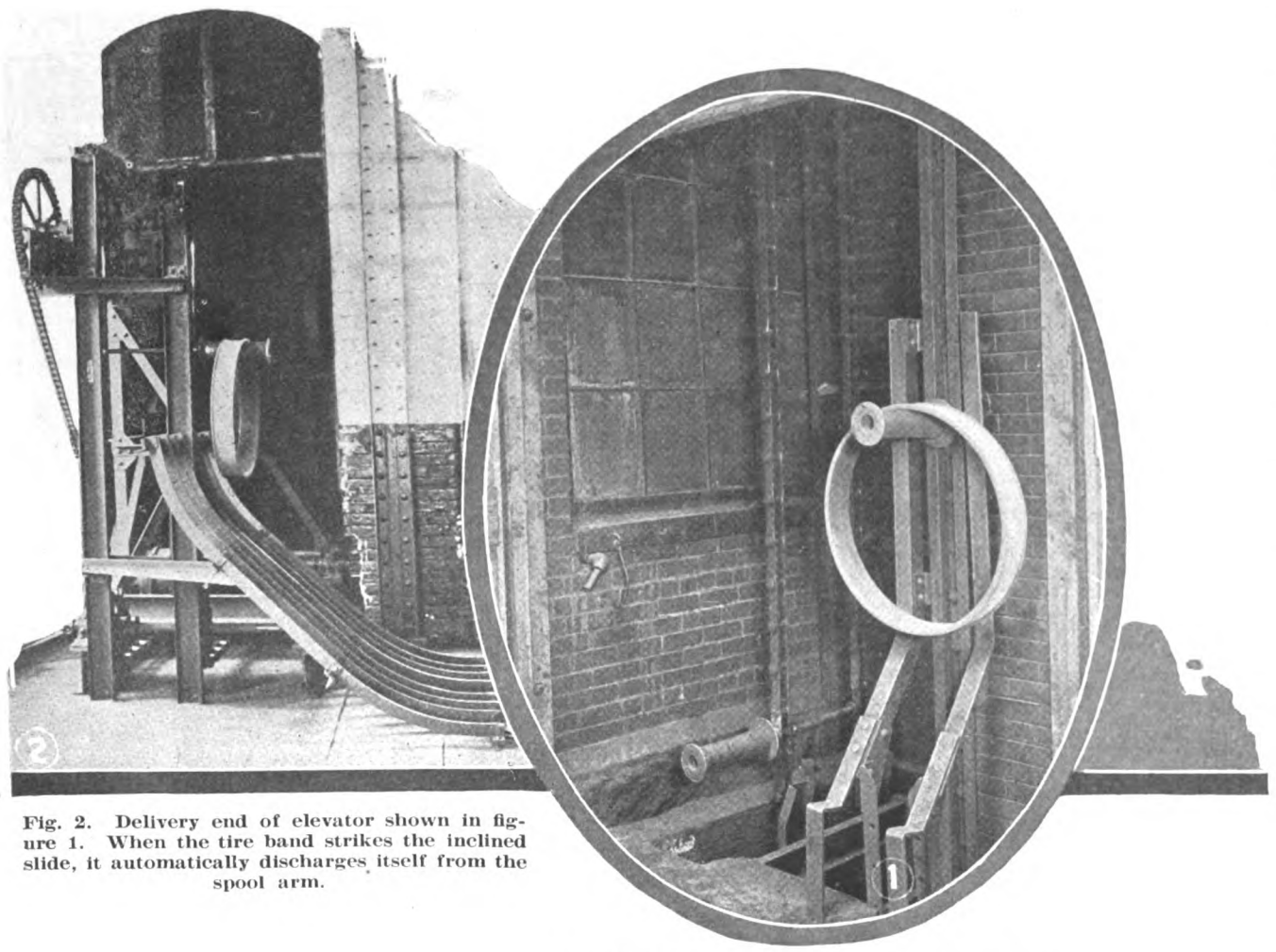


Fig. 2. Delivery end of elevator shown in figure 1. When the tire band strikes the inclined slide, it automatically discharges itself from the spool arm.

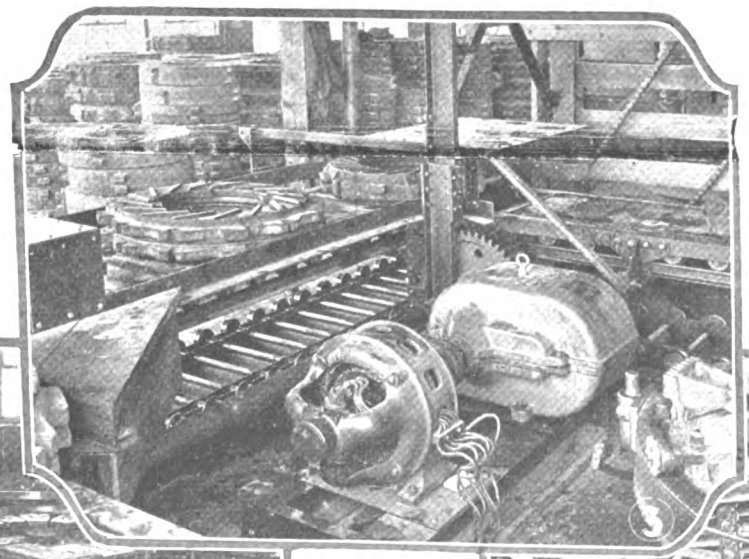
Fig. 1. Illustrating method of carrying band, and the ease with which same is loaded on spool arm.

QUITE frequentiy the handling of certain classes of materials mechanically, is considered impossible, because the manufacturers' catalogues do not show, and their representatives do not know of the many ingenious devices that have been made up from standard parts, and which are now successfully performing mechanically, operations that have always been considered as necessary evils to be performed by hand labor.

Many of these devices are considered as trade secrets by plant executives, and are closely guarded, so that other plants cannot use them as a means of reducing their production costs. Because it is so simple to buy standard sprockets, chains and attachments, it is not difficult for the engineering department of a plant to design and build conveyors to fit their particular requirements. While we cannot entirely condemn the attitude of plant executives in keeping the design of this equipment secret, we do feel however, that they would gain a number of new suggestions, and would do much to promote the particular industry in which they are interested if they would more fully describe the design and operation of

Fig. 3. Special, extra-heavy channel iron platform conveyors, handling tire moulds in rubber plant; showing method of transferring from one conveyor to another, at right angles, also layout of drive.

Fig. 4. Continuous single run horizontal platform conveyor showing method of drive, and how platform sections are bevelled to permit turning right angle corners.



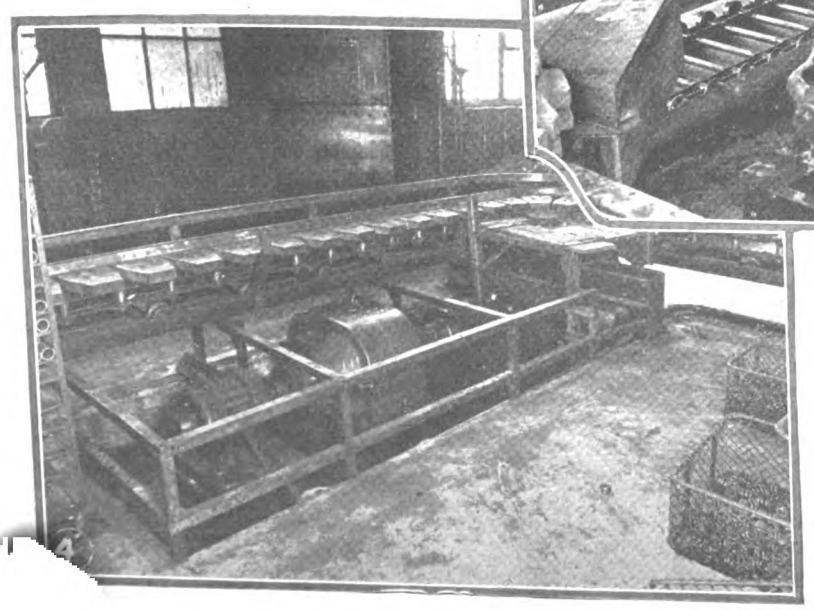
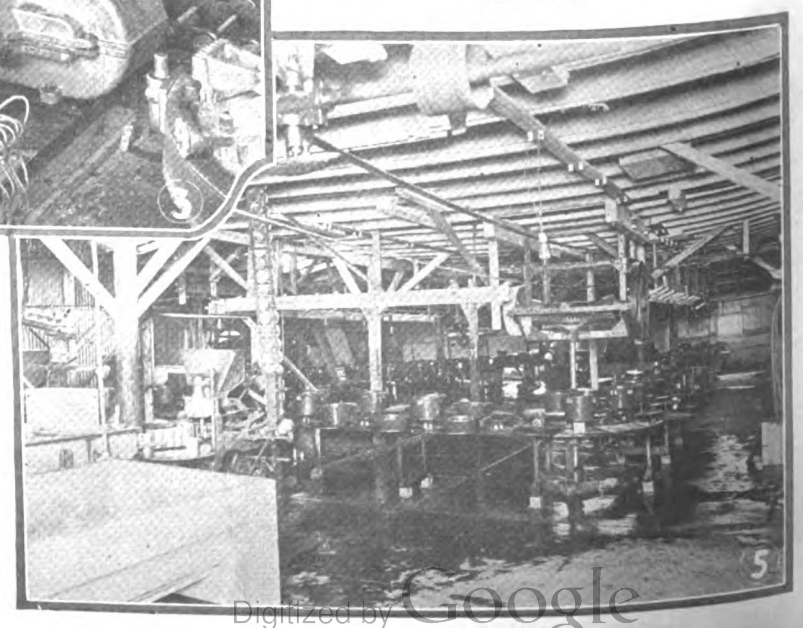


Fig. 5. Continuous peeling table in modern cannery. A machine designed for the particular needs of this industry.



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Fig. 6. Close view of continuous peeling table, showing bracket supports for buckets and pans. This class of quipment makes for sanitary conditions, increases production, and saves space.

their special equipment, and any detail as to what savings have been effected by this installation.

The use of mechanical equipment for handling all classes of materials does not only provide a remedy for overcoming the present labor shortage, but it eventually will have direct reaction upon reduced prices, and reduced prices benefit all, from the laboring man to the banker, provided the profits are not cut in order to bring about this reduction. If we reduce the cost of production, we can reduce the prices without cutting profits, and that is what materials handling equipment does.

To show what we mean by special device, we will look at figures 1 and 2, which show the method of loading and unloading an elevator for tire bands at the plant of the Revere Rubber Company, Providence, R. I. The elevator is located outside the building, and has at the top a short horizontal run to carry the bands into the building at an upper floor. The bands are placed on the bracket to the right, at ground level, and are picked up by the spools shown in figure 1, are elevated vertically and automatically delivered on to unloading skids at the end of



Fig. 7. A steel apron conveyor built in as a part of the washing operation in a grape juice plant. The conveyor not only handles the grapes through the washer, but it elevates them into the factory.

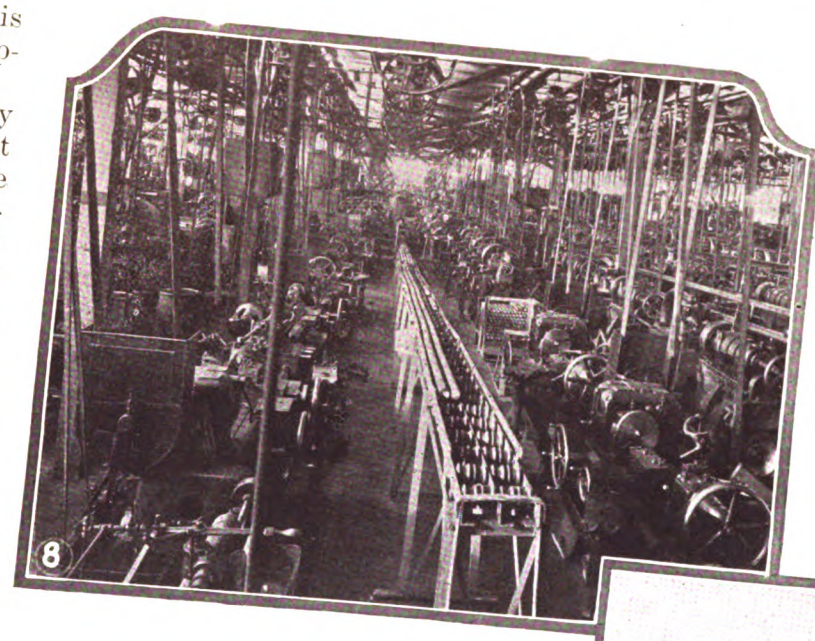


Fig. 8. Special gravity conveyor with concave rollers, handling steel shafting between machine operations. By changing the design of the conveyor rollers, various odd-shaped materials can be handled by means of gravity.

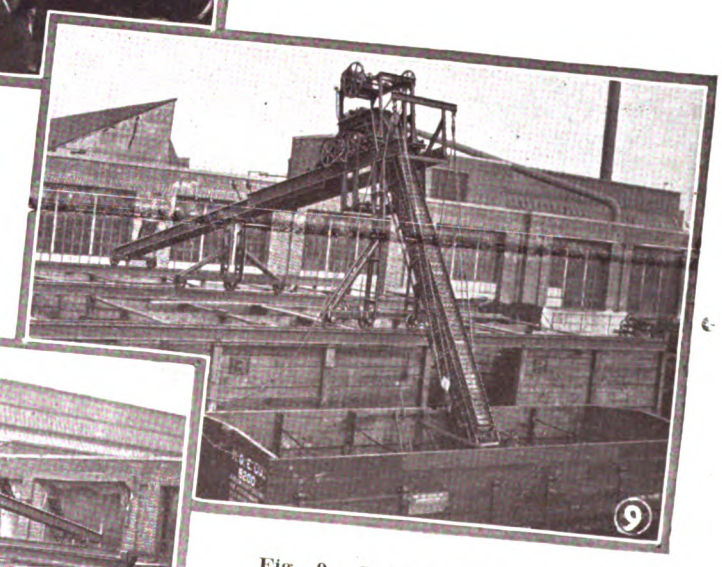


Fig. 9. Special combination slat elevator conveyor and gravity roller conveyor machine for handling pig iron from cars to storage bins.

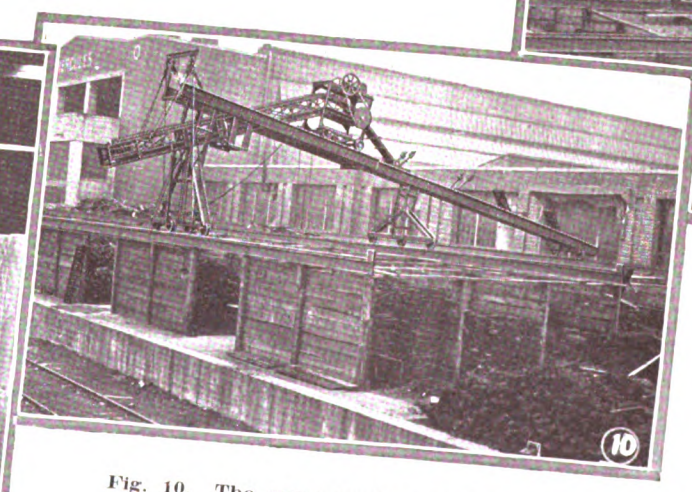


Fig. 10. The same machine as figure 9, with elevator unit hoisted to permit passage of cars on railroad tracks.



Fig. 11. Special dolley conveyor handling 300-pound rolls of roofing paper between factory and dock, at the rate of 300 rolls per hour.

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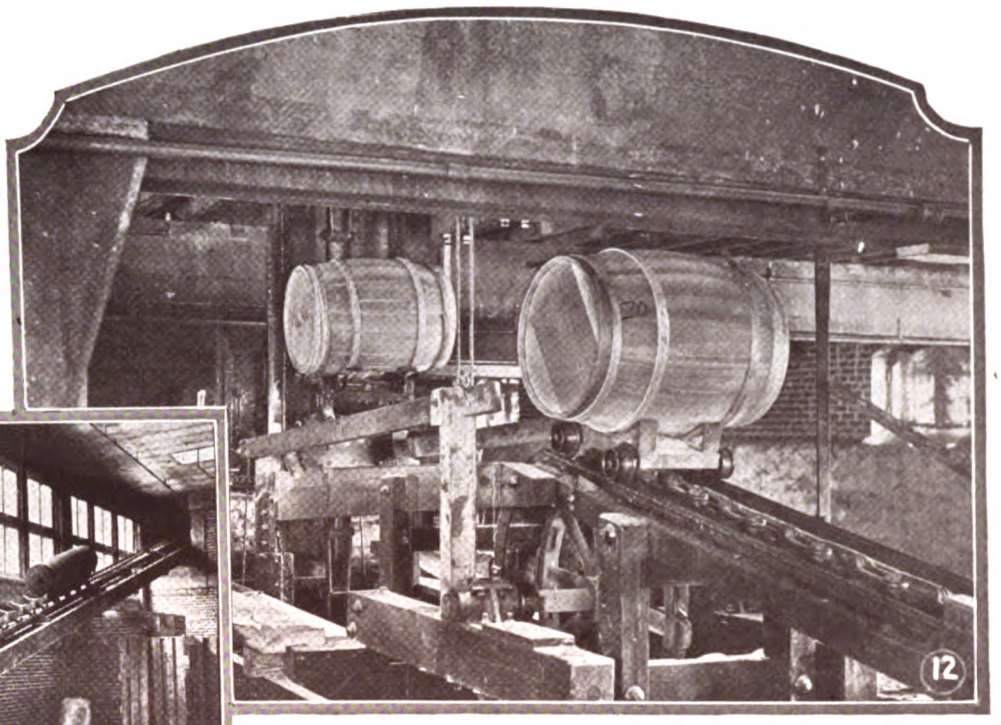


Fig. 12. Showing method of discharging from special dolley conveyor, to barrel arm elevator. Note guard-rails to keep the barrel in a straight path.

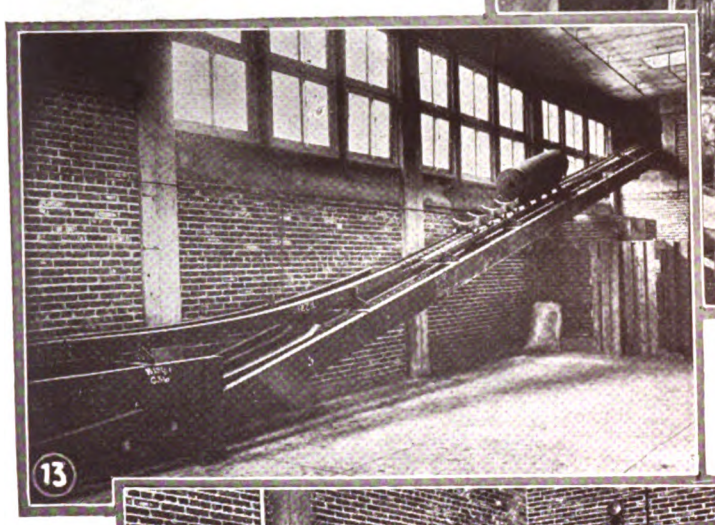


Fig. 13. Long rolls of materials are unwieldy in handling. This is a good method of conveying and elevating such rolls.

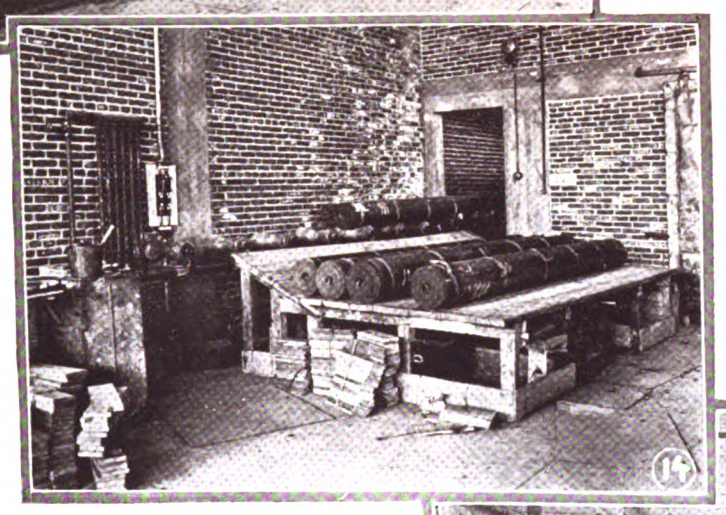


Fig. 14. When discharging from conveyor shown in figure 13, the conveyor pushes the rolls of goods on to concave stationary rollers as shown; by tipping the rollers, the goods are discharged to the platform.

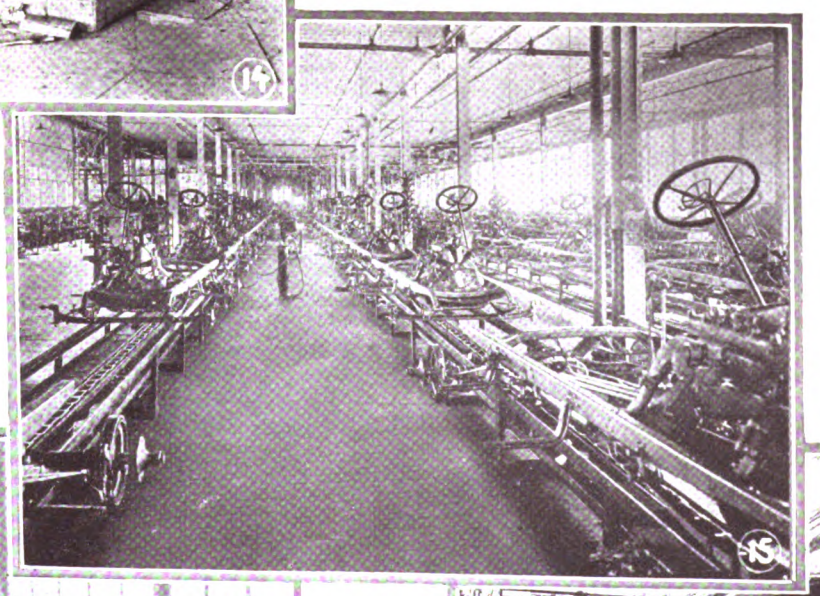


Fig. 15. A battery of five conveyors for continuous movement of automobile chassis on assembly operations.

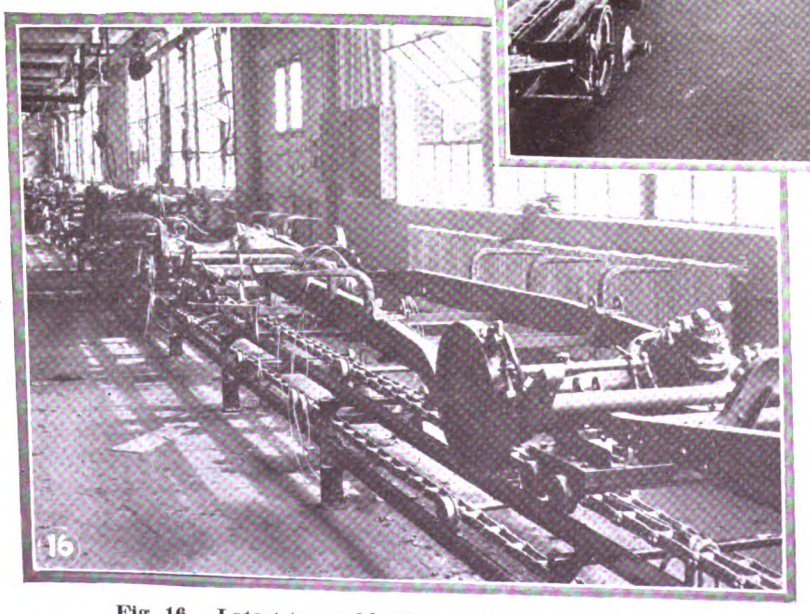


Fig. 16. Latest type of load carrying conveyors, used on automobile assembly operations. Note the construction of special dolleys for carrying the chassis, and additional wheel supports for the chain.

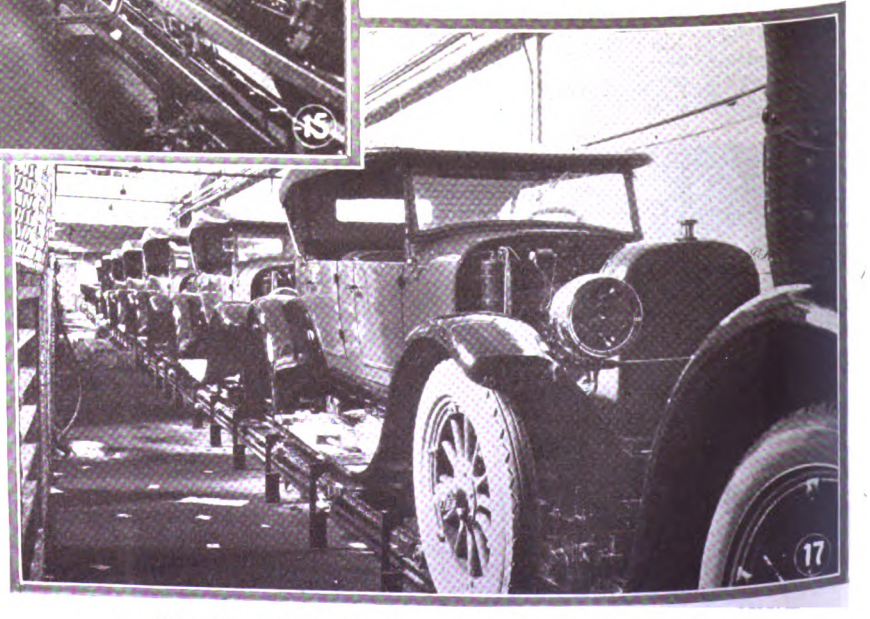


Fig. 17. The same type of conveyor as figure 16, with automobile nearing complete assembly, just prior to being discharged from the conveyor run.

horizontal run as shown in figure 2.

This is a special application of an arm elevator, and is made up of standard chain and sprockets, the special parts being the spool and the method of loading and unloading. While the savings effected are not published, there is no doubt that the installation was a good investment.

In many industries it is necessary to use continuous conveyors which run in the form of a hollow square. To show the difference in construction of these conveyors, to fit various industries, it is necessary to look at figures 3, 4, 5 and 6. In figure 3, we see a right angle inter-section of a steel channel platform conveyor, for handling moulds for automobile tires in the curing room of a rubber plant. This also clearly illustrates

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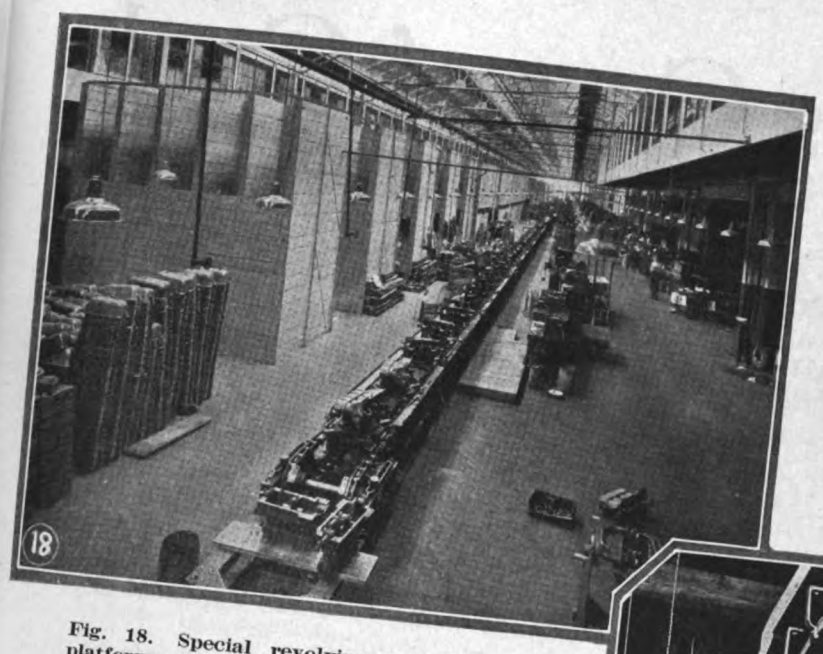


Fig. 18. Special revolving turn table platform conveyor for handling automobile engines on progressive assembly operations. This conveyor saves considerable non-productive labor expense and valuable floor space.

the method of driving these conveyors. In this case, separate runs of conveyor are used, and the moulds are fed from one conveyor to another at the corners, being guided by means of angle guard rails. This illustration also shows on the bottom run of the conveyor, the special construction of a heavy channel iron platform conveyor. It will be noted that the platform is made up of standard channel iron section, and the chain is special, being connected together by means of heavy rod, upon the ends of which are large rollers, running on tracks which carry the load. This equipment is of extra heavy construction, and is therefore necessarily a special design machine.

(*Continued on page 28*)

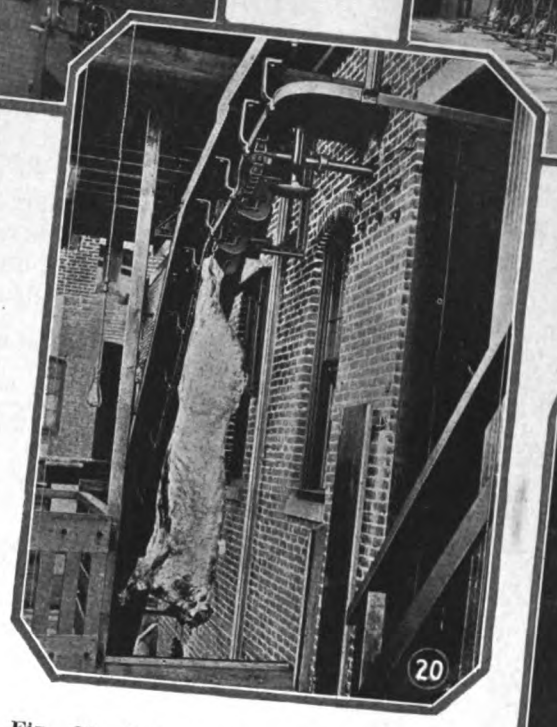


Fig. 20. The packing industries use miles of overhead trolley conveyors. This shows a chain with attachments, which operates as an aid on the inclined uphaul for elevating sides of beef.

Fig. 21. Special feeding conveyors are as essential as the other equipment. This shows a special conveyor for automatically feeding vertical arm elevators.

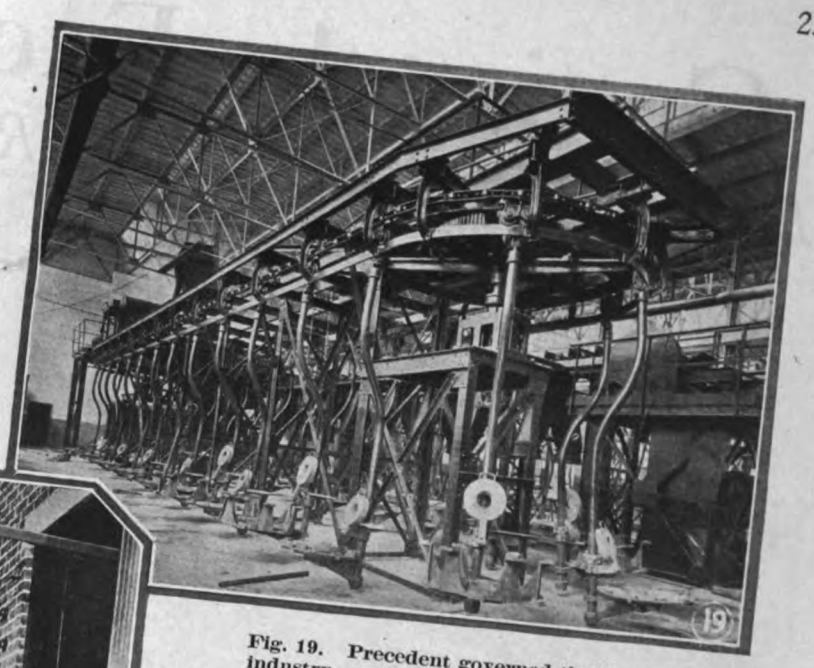
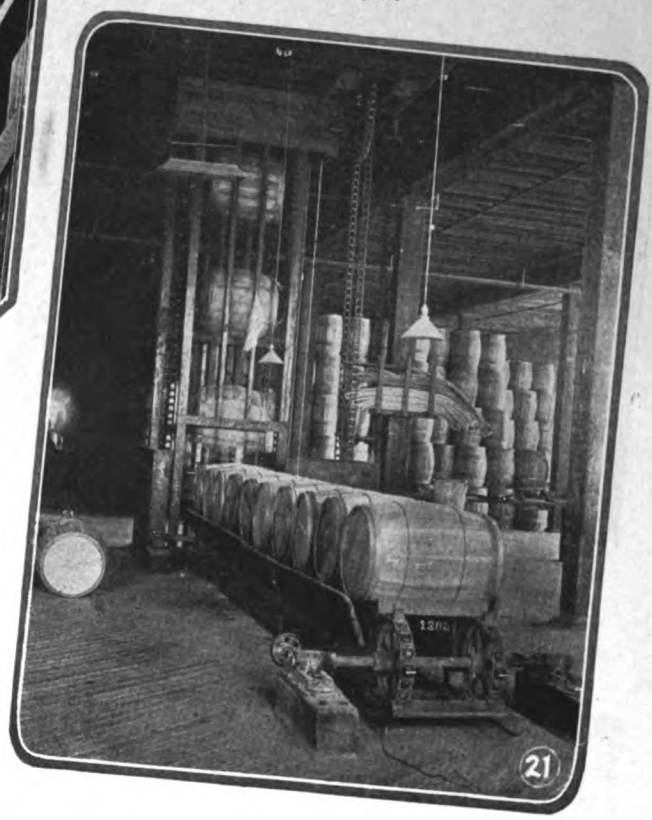


Fig. 19. Precedent governed the foundry industry until it was necessary to give quantity production. When the production needs called for it, conveyors solved the problem, and saved money and space. This is a special continuous mould conveyor.



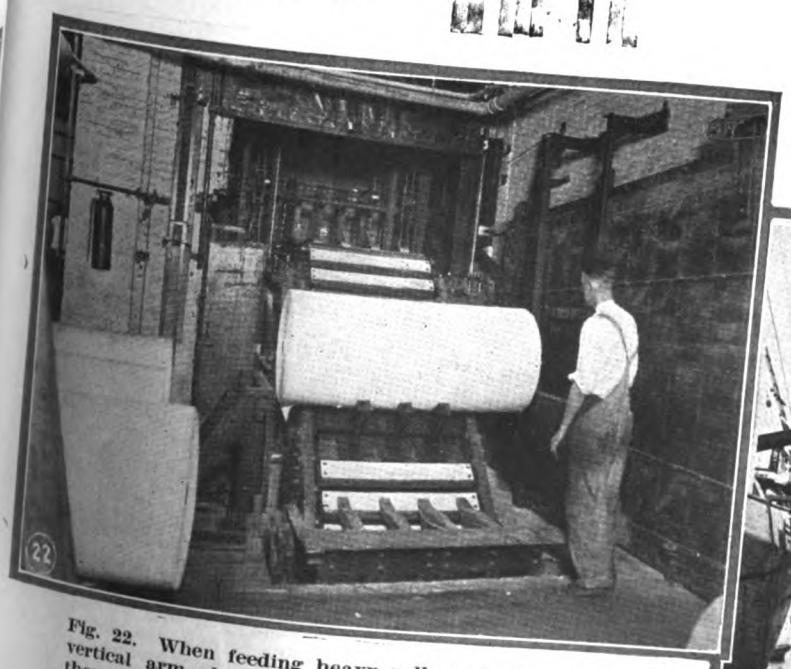


Fig. 22. When feeding heavy rolls of paper to vertical arm elevators, it is necessary to feed them at just the proper time. The device shown insures automatic loading to the elevator.

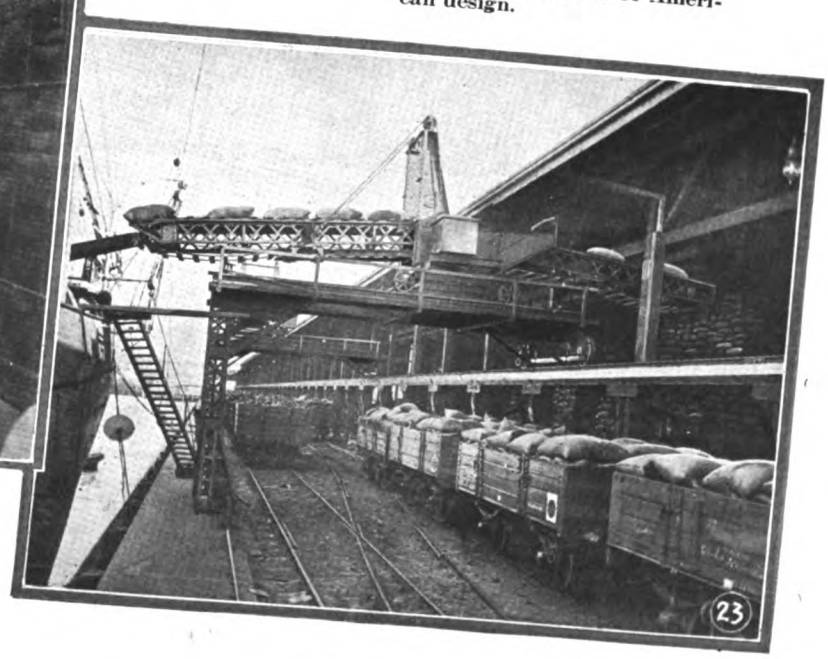


Fig. 23. Special American-made equipment is also operating in foreign countries. This conveyor loading vessels in a port in Australia is of American design.

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Cutting the Excess Cost of Coal

Equipment that Shortens the Road from Mine to Boiler House

By James T. Beard, 2nd

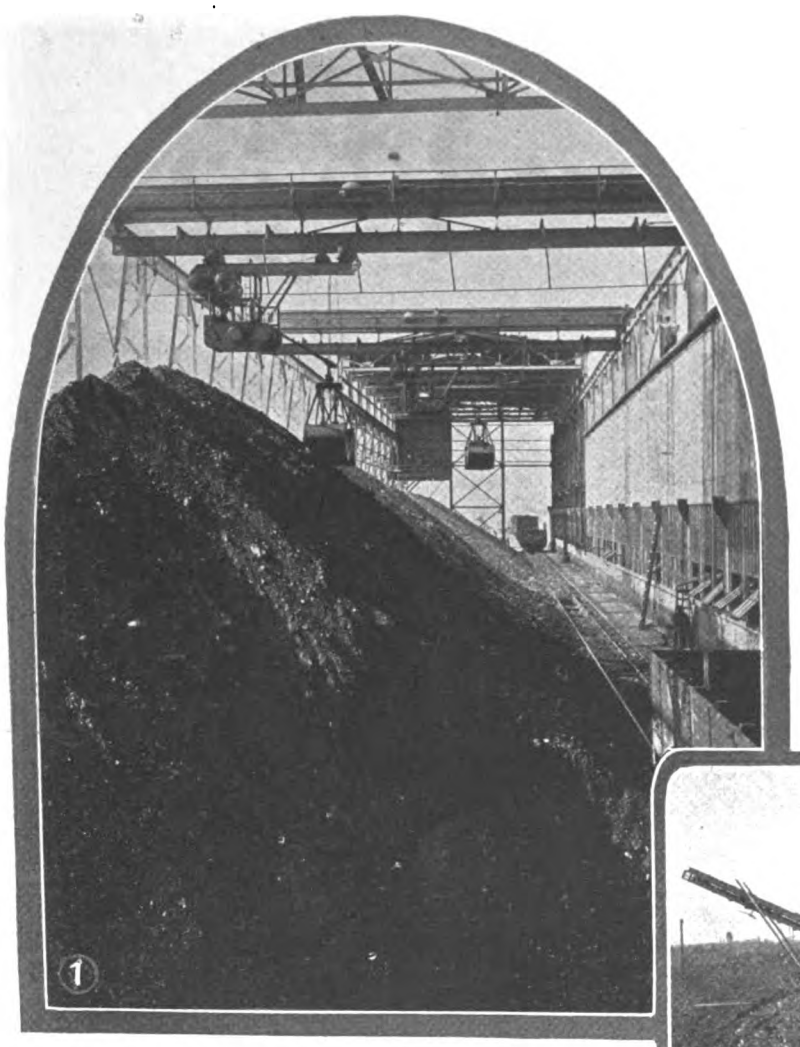


Fig. 1. Electric hoist and grab bucket, operating on a transfer crane, unload cars as they are shifted to boiler house siding. The coal may be deposited on the storage pile at the side, or if the bunker supply is low, the hoist and load is run from the crane onto a monorail track directly into the boiler house.



THERE are many reasons why the problem of handling coal in the average industrial power plant has attracted the thoughtful consideration of managers, superintendents and engineers, but perhaps the most potent of these are the increasing cost, unreliability and wastefulness of hand labor today. If our power plants could be transported by some magic "presto" to faraway lands where a day's labor can be bought for a few yens or a handful of kopecks, we would be troubled very little by the fuel-handling question. But the present-day conditions in the labor market of this country make the cost and methods of transferring coal from the cars to the boiler house a very important and substantial item of the operating cost and dependability of the plant.

Fig. 2. Portable loaders and unloaders afford inexpensive and flexible means of solving the coal handling and labor problems in many plants. Two unloaders are shown here operating in series to unload the coal from the railroad car to the storage pile.

Large industrial plants are usually located on a railorad spur or at the water front, to minimize the cost of handling the finished product and the raw materials, including coal. In such stations the large quantities of coal handled daily often warrant elaborate conveyor systems that would not be justified in smaller plants.

Many industrial plants, however, are located in the midst of cities, where switching facilities are not available and where coal must be handled as it comes from the 5 or 10-ton trucks.

No matter what system is provided for handling the coal at the plant, it must include adequate allowance for storage. The quantity of coal in this reserve must, naturally, be sufficient to operate the plant during periods of interrupted delivery, strikes, etc. In small plants these storage bins may be located within the building itself. Ordinarily it

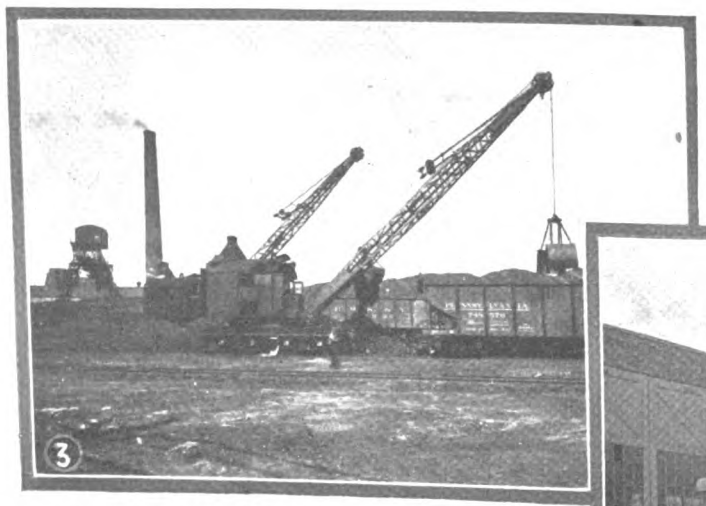


Fig. 3. In large plants where several cars of coal are handled in a day it is certainly economical to use a locomotive crane for loading onto the storage pile. The equipment shown here is of the steam-driven type.

Fig. 4. In smaller plants a gasoline-driven tractor type of crane does the work of many men. When not used in feeding the storage pile, it has many other uses which make it a profitable investment.



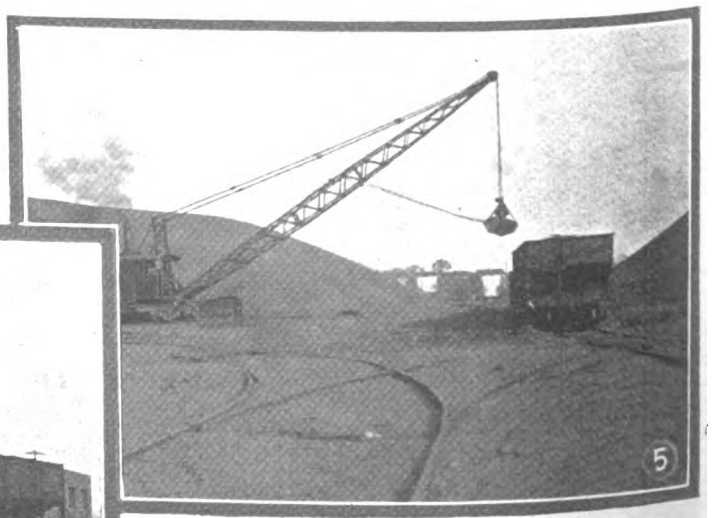


Fig. 5. Locomotive cranes with long boom spans assure rapid unloading and are particularly adapted to stocking up large storage piles. Considerable work can be accomplished from a single position.

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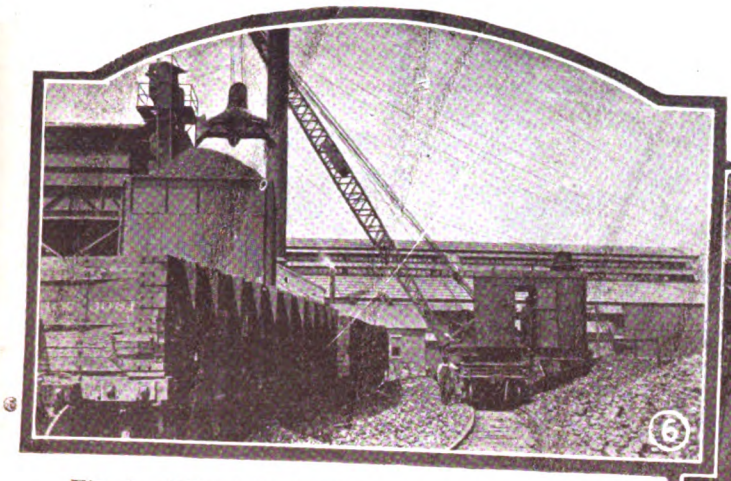


Fig. 6. Where no trestle is provided for in the design of the coal handling system, the locomotive crane performs a valuable service in transferring the coal from the cars into an overhead hopper, whence it drops into suitable crushers below.

is a good plan to carry a four or five days' supply within the plant and, in view of the experiences of the past few years, it is certainly advisable to provide outside space for a much larger reserve, depending upon the size of the plant.

Where plants are located upon a railroad siding the unloading problem is usually very simple. If a spur can be run alongside the boiler house, drop-bottom cars can be emptied quickly into a hopper beneath the tracks, discharging from there into a roll crusher. But the supply of drop-bottom cars cannot always be depended upon and provision must also be made for unloading by means of a grab bucket. Unloading from cars to the reserve pile in the yard is done by a locomotive crane.

Clam-shell drop buckets are suitable for unloading barges, if the plant is located on the waterfront.

In the storing of coal, both in the yards and in bunkers, many difficulties are often experienced with certain grades of fuel. Spontaneous combustion is sometimes a serious factor to be contended with, par-

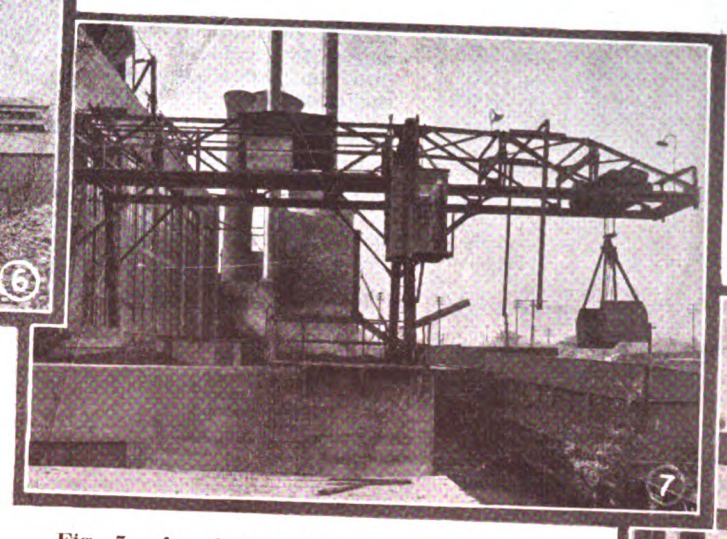


Fig. 7. An electric gantry crane with cantilever span gives a simple solution to what is often a difficult coal handling problem otherwise. The equipment in the picture shows how coal is transferred from cars on the siding into the hopper above the crushers.



Fig. 9. This particular electric hoisting crane is designed to handle ashes and eliminate the wheelbarrow method of getting them out of the boiler house. The drudgery and cost with the use of the latter system is absent here.

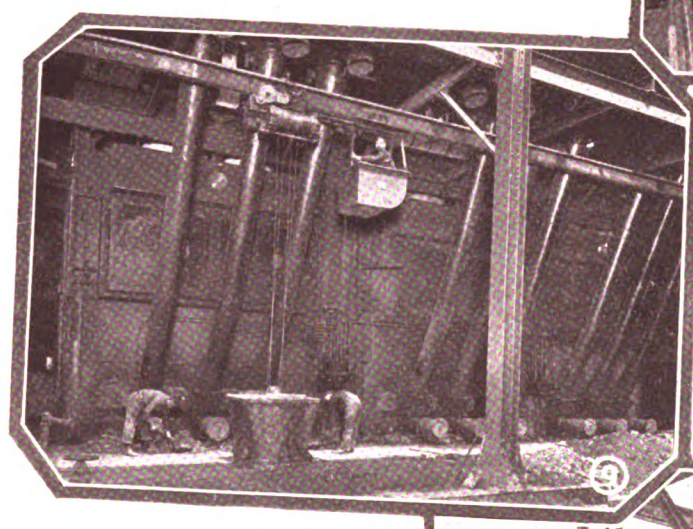


Fig. 8. With the type of electric crane hoist shown here it is not only possible to unload coal from the cars into the boiler house, but to remove ashes and load them into empties as well.

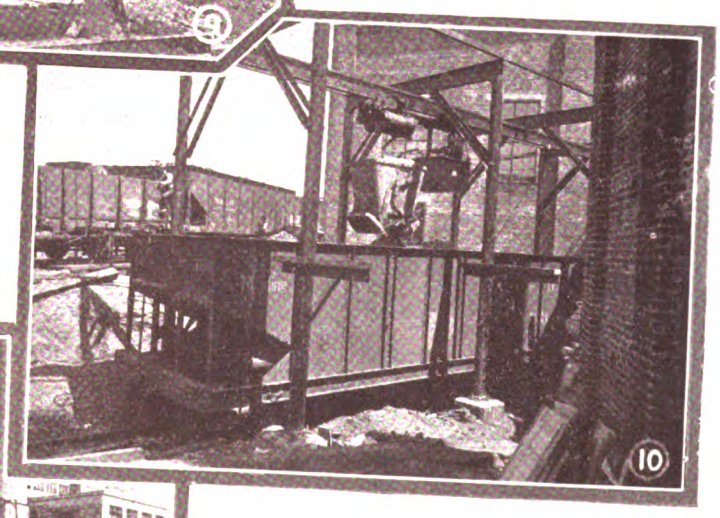


Fig. 10. Traveling out of the boiler room door along an overhead track, the electric ash hoist carries ashes to any desired point and may deposit them either on the dump or in railroad cars to be hauled away.

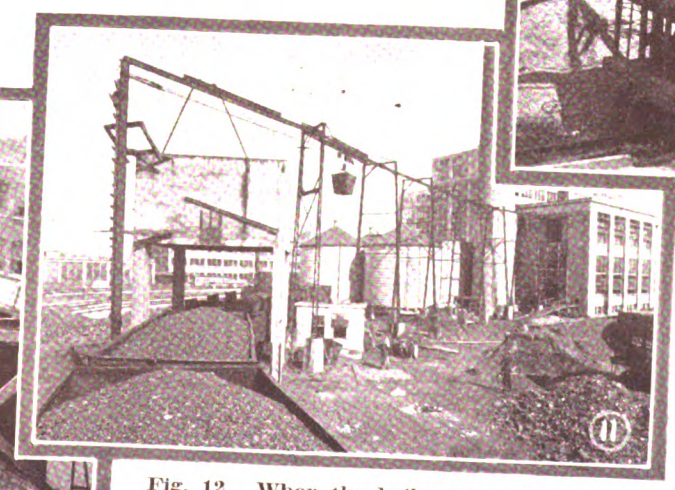


Fig. 11. Another combined coal and ash handling system that is characterized by its simplicity, low first cost and ease of operation. Coal is unloaded from the cars into the bunkers and ashes are in turn dumped into the concrete ash bin.

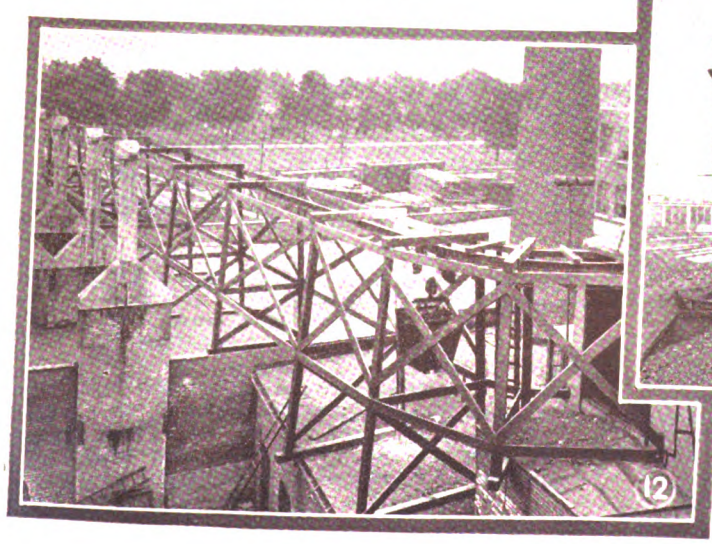


Fig. 12. When the boiler house is located in a spot not conveniently reached by the railroad siding, an overhead track similar to the one shown here solves the problem in a simple and economical way.

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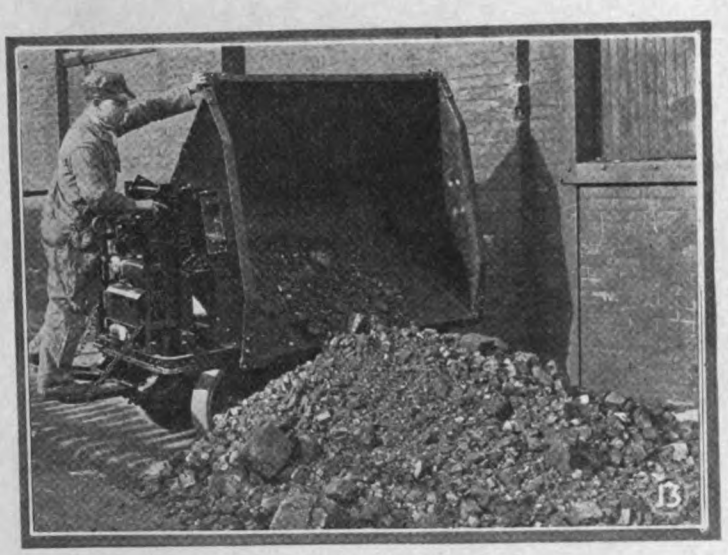


Fig. 13. Beats the wheelbarrow all hollow! Here's an inexpensive and efficient way of getting the coal from the storage pile into the boiler house and is often the only solution left if other methods are fund impractical.

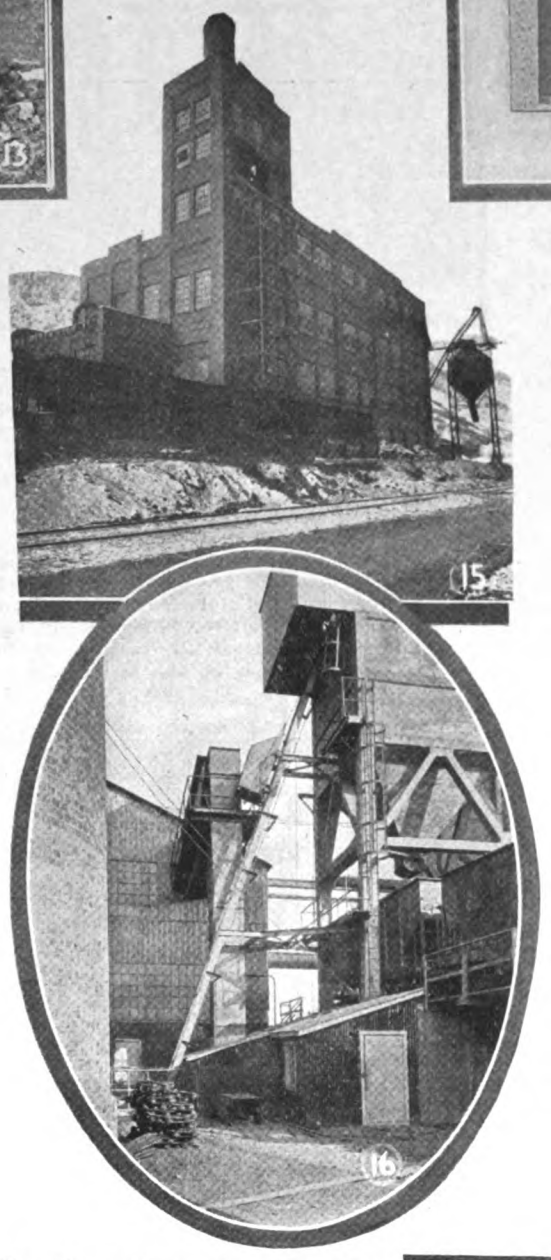
ticularly when there is a large content of iron pyrites. Once a storage pile has caught fire it is usually a very difficult matter to extinguish it and involves turning the pile over, which is an expensive proposition at best.

Spontaneous combustion occurs because the heat produced by the slow oxidation of the coal is not carried away by adequate ventilation. The temperature, consequently, increases until the coal itself ignites.

In storing coal that is subject to spontaneous combustion it is usually desirable to divide it into small piles, rather than lump it into one big mass. Iron pipe, capped at the bottom, should be inserted into these piles so that temperature readings can be taken to indicate the presence of fire in the pile and to forestall a temperature condition that would

(*Continued on page 57*)

Fig. 15. How the skip hoist actually looks. The frame work in the foreground carries the tracks almost vertically up the side of the boiler house, where they suddenly turn into the tower, allowing the carriage to discharge into the bunkers. In the background is a similar hoist for handling ashes.



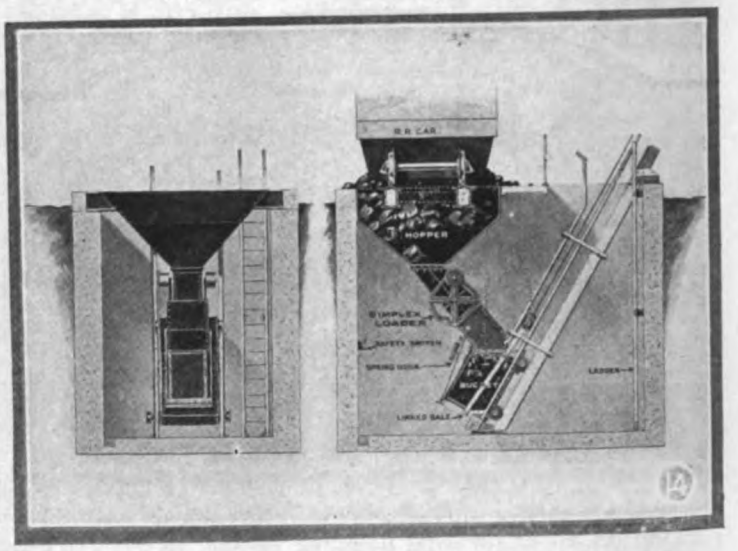


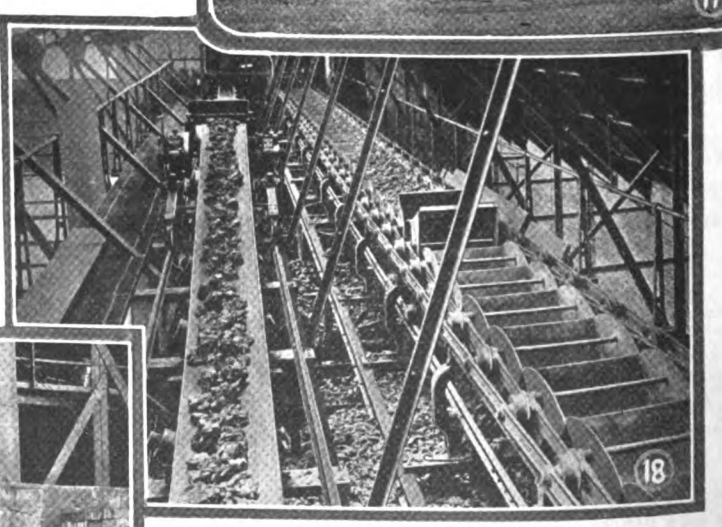
Fig. 14. Another successful solution of the high cost of ash handling is the skip hoist, consisting of a carriage hauled at high speed up a very steep incline and discharging its load at the top into suitable bins. This system is successfully used in many plants for handling both coal and ashes.

Fig. 17. From railroad cars, coal is dumped into a hopper under the tracks, whence it is fed through a plate feeder into a roll crusher. It is then delivered to the bucket elevator shown rising along the side of the structure and is carried up to the storage bin. From this bin it is distributed by a 10-ton man-operated traveling hopper to the several bins in the boiler house.



Fig. 16. Another view of a skip hoist showing the carriage half way up the steep incline. This is part of an ash handling system for discharging the refuse into a concrete overhead bin, whence it is carried away by railroad cars.

Fig. 19. The corrugated surfaces of an apron conveyor enable them to carry coal up steep inclines to a distributing belt conveyor over the bunkers.



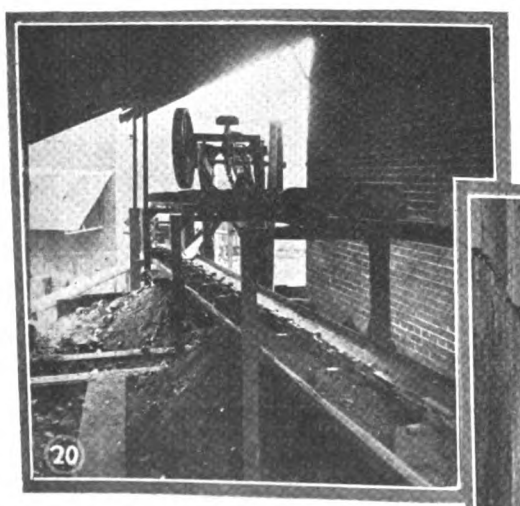


Fig. 20. A drag or scraper conveyor is adapted to service either for handling ashes or carrying coal. It is in successful use in many power stations for both purposes.

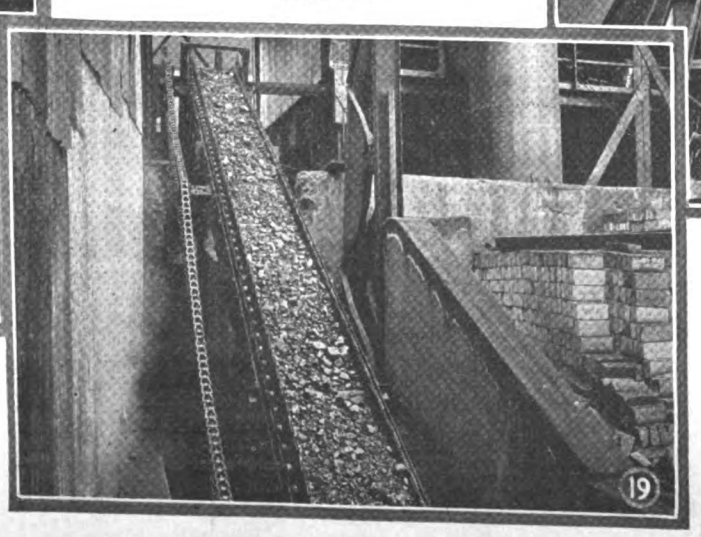


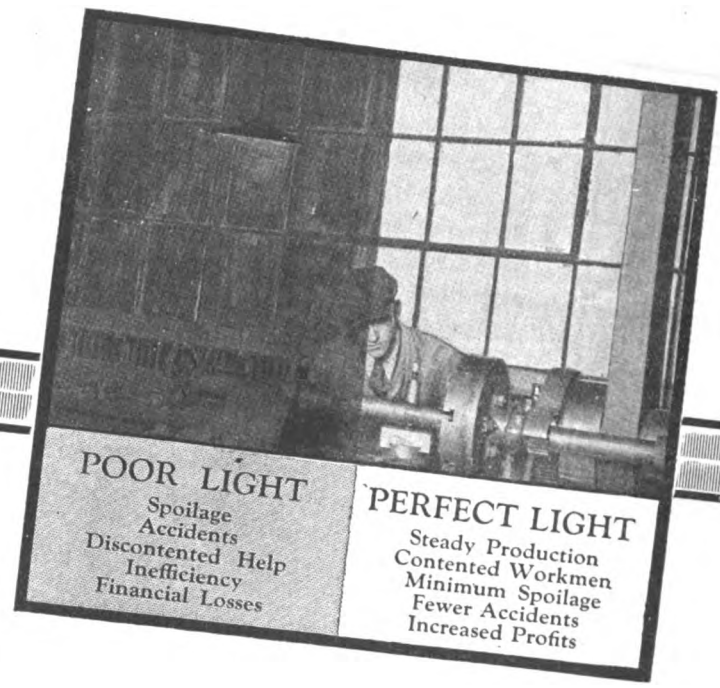
Fig. 18. Interior view in a boiler house showing the employment of both a belt type and bucket type of conveyor for carrying coal to the bins underneath. The bucket type of conveyor may also be utilized as an ash conveyor and it is sometimes designed to run through the ash cellar under the ash pits. The bolt conveyor is frequently used in conjunction with a bucket elevator for distributing coal in the bunkers.

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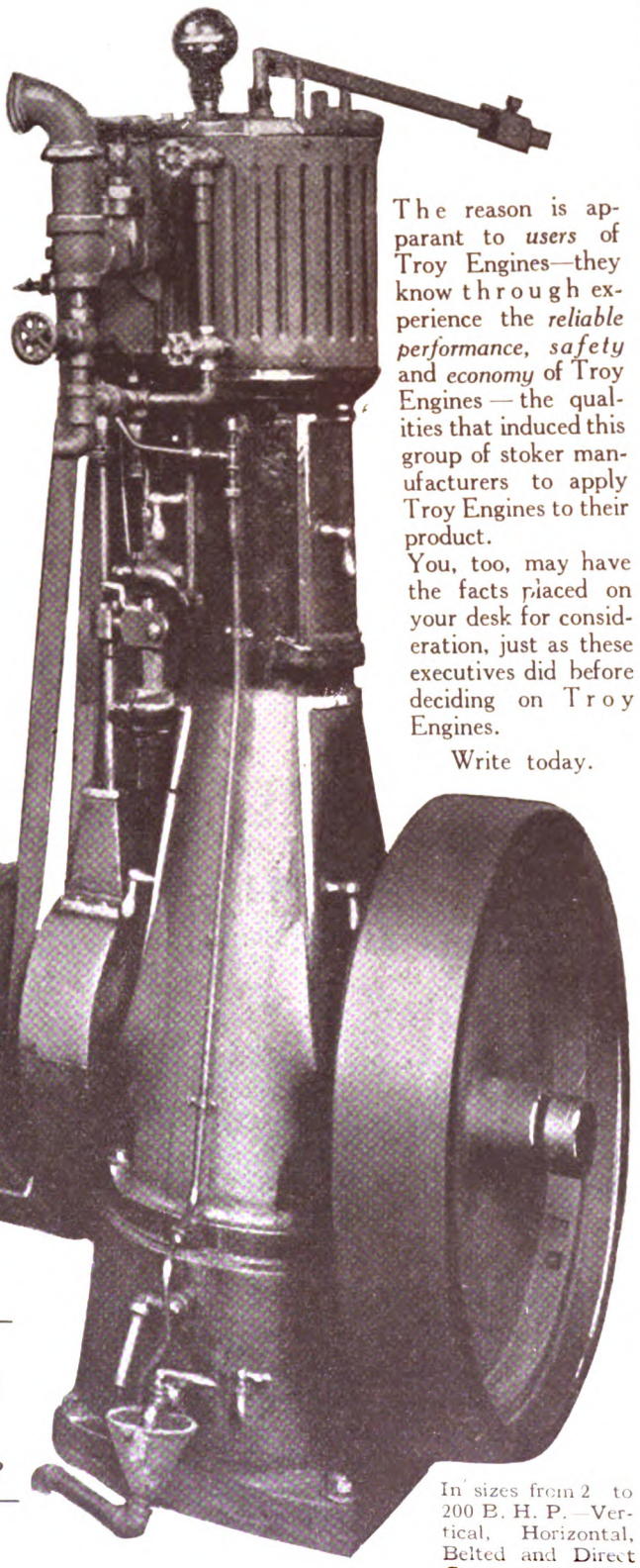
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(*Continued from page 23*)

Looking at figure 4, we see a different method of turning a corner. In this case, we have an endless platform conveyor running in a horizontal plane, turning all four corners at right angles. It will be noted that there is no return run to this conveyor, and the entire conveyor passes around the corner, the guard rails being an additional precaution to insure material remaining on the platform.

The heavy wooden slats are bevelled on the inner side, so as to permit turning the corner. One strand of heavy chain is used, which engages with a sprocket placed horizontally. The detail of drive by means of bevel gears is clearly shown. The entire conveyor and load is carried on the roller carriages which run on tracks, and which can be seen beneath the driving chain. This conveyor performs very heavy duty, and is therefore of very solid construction.

Using the same principle but different construction, we see in figure 5, a method of driving a continuous peeling table, now operating in modern canneries. The heart of a tomato canning factory is the peeling system, and such a conveyor effects a continuous movement of tomatoes and acts as a flywheel for the plant by systematizing and regulating the peeling. The conveyor keeps the peeler supplied with tomatoes, removing the buckets filled with peeled tomatoes, as well as the empty buckets and pans.

Figure 6 shows a close-up view which illustrates how easy it is to remove a bucket from the conveyor, and also how the conveyor structure supports the pan in which the peeler places the tomatoes. Peelers can work on both sides of the conveyor run.

In the manufacture of beverages, many standard conveyors are used in the handling of bottles, cases, etc., but figure 7 shows an ingenious use of the steel apron conveyor, for carrying grapes through and from the washer, up an incline, into the factory, where they are manufactured into grape juice. This conveyor is built along the standard lines of an apron conveyor, and is fitted with a sieve platform, which drains off the water. The angle construction on top of the platform provides ledges, to keep the grapes from rolling back on the inclined run. The gravity conveyor shown is not special.

We do, however, see in figures 8 and 9, a special gravity conveyor, and a special arrangement of a gravity conveyor. In figure 8, we see a conveyor for handling [illegible] lengths of steel shafting, between machine operations in a large congested machine shop. This conveyor is equipped with special rollers concaved, so that the shafting can be easily carried. With such congested conditions, it would be impossible to bring to, or take this material away from the lathe by hand truck methods. Other runs of gravity conveyor can be seen in the background. The special arrangement of gravity conveyor, figure 9, also shows the use of a special slat conveyor, fitted with attachments, for elevating pig iron at the Hercules Gas Engine Company, Evansville, Ind. The tracks upon which this equipment is mounted permits moving it in a horizontal direction, so as to unload cars which are spotted at various points on the track. The pig is loaded directly from the car to the slat elevator-conveyor, which discharges it to a run of gravity conveyor. This gravity conveyor is fitted with hinged sections, counter-weighted, one of which is shown opened at the end of the run. There are four of these counter-weighted sections in the entire run, and by opening these various sections, the pigs can be diverted into the different bins.

The gravity conveyor in this installation is special, because of the extra heavy construction required in the handling of pig iron.

After the car is unloaded, the slat elevator-conveyor is raised by means of pulleys and winches, as shown in figure 10, which permits the passage of trains on the railroad tracks, figure 10 also shows the general arrangement of the bins, and two of the gravity conveyor openings.

This is a special piece of

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possible" machinery, designed to meet a special condition, but no doubt the same idea can be used in other industries for handling other materials.

Another type of special conveyor, and one which it would be difficult to name, unless it is called a dolley conveyor, because of the carrying medium, is shown in different installations by figures 11, 12, 13 and 14. It will be noted that the conveyor consists of a number of four roller trucks, attached to an endless chain. Figure 11, is a reversible conveyor, 288 feet long handling 300 pound rolls of roofing paper between wharf and factory. In order to avoid accident a bell system is installed, and the code of bells is shown on the post to the left. One bell signal stops the conveyor, 2 bells start it delivering goods to the dock, and 3 bells start it delivering goods from the dock to the factory. This equipment is efficient, and economical of power, and when run at moderate speeds, has a very high capacity. The capacity of this particular conveyor is 300 rolls of paper per hour.

As stated at the beginning of this article the installations shown are special. Figure 12 shows a dolley conveyor feeding to a 70-foot arm elevator, by which barrels are delivered at any of five floors in a warehouse. The conveyor in this instance is 100 foot span, and runs beneath the street. The whole installation is synchronized and is driven by one motor. An automatic feeder is timed to deliver barrels properly to the conveyor, which in turn delivers them in proper timing to the elevator arms.

The handling of long rolls or pieces of material, has always been considered difficult. Figures 13 and 14 show how a conveyor will carry long rolls of oilcloth, linoleum, carpet, etc., and also the method of unloading this conveyor. The conveyor consists of 8 saddles fastened to a chain. The goods to be conveyed are loaded upon these saddles and conveyed either in a horizontal or inclined plane. The method of discharge is clearly shown in figure 14. At the end of the conveyor, the roll is delivered to rollers where it is discharged by the tilting of the roller and delivered to a platform.

There is no one industry that has made more use of special conveyors than the automotive industry. In practically every plant of this type, conveyors are used on all progressive assembly operations. Figure 15 shows how conveyors are used for assembling cars at the plant of the Willys Overland Co., Toledo, Ohio. This battery of conveyors saves considerable floor space, and insures the work being done within the allotted time. This conveyor consists mainly of a chain which pulls the chassis along on the angle tracks. This is one of the simplest types of conveyors, and represents what the engineers on this job consider the most applicable.

Figure 16 shows a chassis assembly conveyor in the Jordon Motor Car Company, at Cleveland, Ohio, which is the latest design for this purpose. It will be noted that the entire chassis is mounted upon special dolleys, which carry the car on rollers that run on tracks. This reduced considerably the friction, but the construction is much more expensive, than the



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Type of Roof: State whether Flat ☐ Slant ☐ Gable ☐ Sawtooth ☐ Monitor ☐
Pitch of Roof ..... State how many ..... inches to the foot .....
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conveyor shown in figure 16.

The same type of conveyor is shown in figure 17, with the car a few feet from the delivery end, where it leaves the conveyor, entirely completed.

Materials handling equipment (elevators and conveyors) have done much in the development of the automotive industry, and if they were not used, the production would be considerably curtailed, and the expense of cars would be enormous. It is true that if so many cars were not manufactured, it would be easier for jay-walkers to cross the street, and it might therefore be a good idea to pass a law; that in order to safeguard pedestrians, we should prohibit the use of this equipment in the automotive industries. It would be just about as sensible as some of the arguments put forth as to why certain plant executives have not installed the equipment.

While the steel and other industries are crying shortage of labor, nothing is heard in this regard from Mr. Ford, and indeed he is increasing his monthly production of cars. How can he do this? For the simple reason that wherever possible, he has employed mechanical equipment, and now uses labor only on productive operations. His plant is not the only plant that has found it economical to install conveyors, and while two other automotive manufacturers have been mentioned, we see in figure 18, a motor assembly conveyor, 400 feet long, at the Chevrolet Motor Company, Flint, Mich. The saving of floor space and the fewer number of men required after the installation of this conveyor, is almost beyond belief.

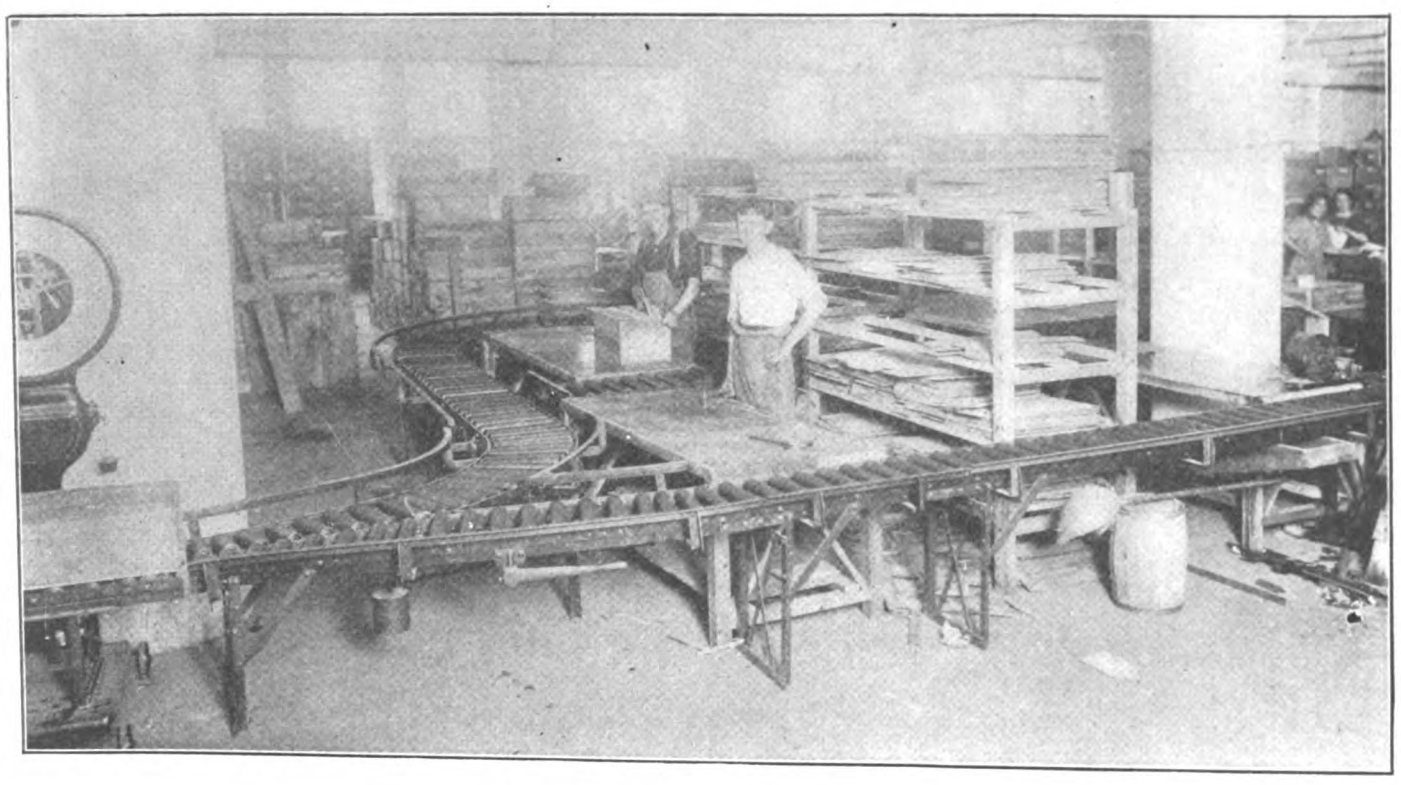
Particular attention should be paid to the turn table carrier, on which the motor is mounted while riding on the conveyor. This permits the workman to turn the engine at any angle he desires. Attention is also called to the placing of parts along the run of the conveyor, and the small work trough mounted on the conveyor supports for holding tools, etc. These special conveyors are not new though we are really just starting to develop the use of this class of equipment.

For years precedent ruled the foundry industry, and improvements were at a standstill. When quantity production was required, it was found that by the old methods considerable land was required to build a foundry of the desired capacity. In some instances, it was impossible to acquire this land, due to the price being excessive, or the land not being available at the desired location. Engineering skill solved the problem, and saved millions of dollars that would have been paid out in plant investment.

Figure 19 is a close view of one of the mould conveyors in the Kelsey Wheel Company foundry, Detroit, Mich. In this foundry, mechanical methods are used wherever possible. The result is enormous saving of space, cheaper production costs, and a minimum amount of unskilled labor.

While the automotive industries appear to be the most progressive, other industries are slowly learning the value of installing mechanical equipment for handling materials, and among this group are the meat packers, who have for

(Continued on page 33)



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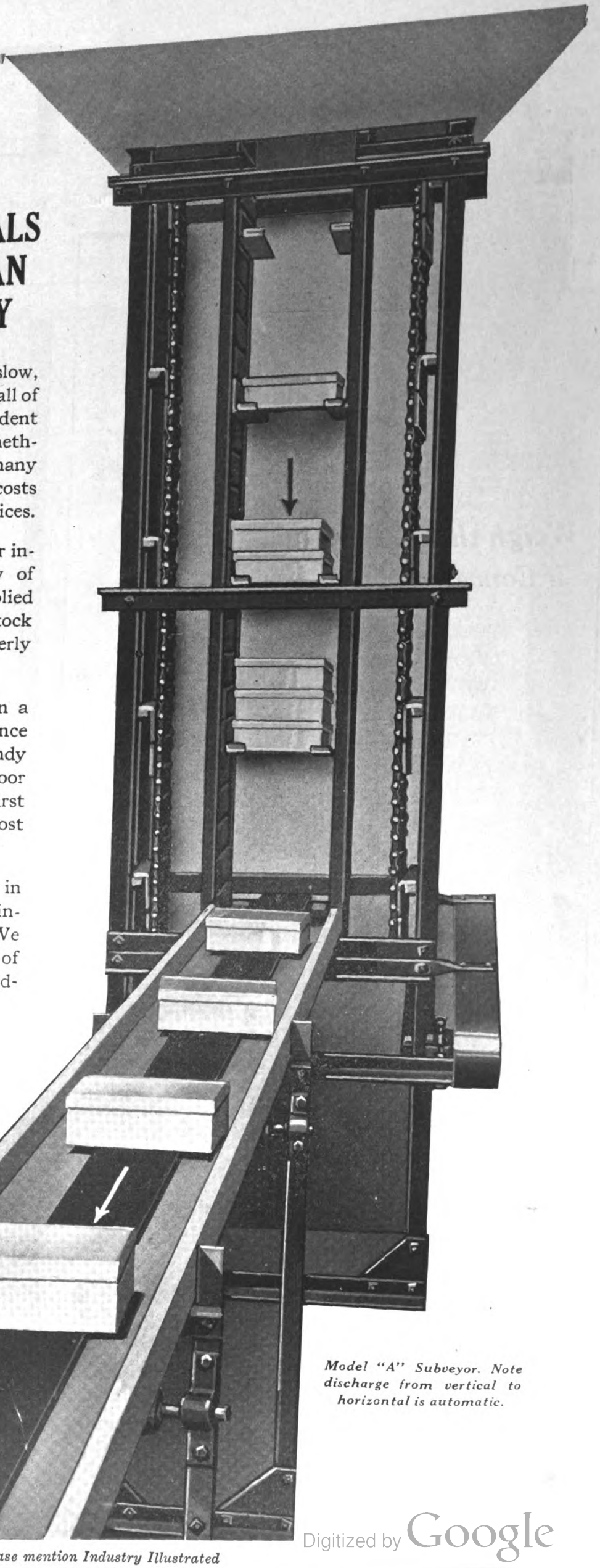
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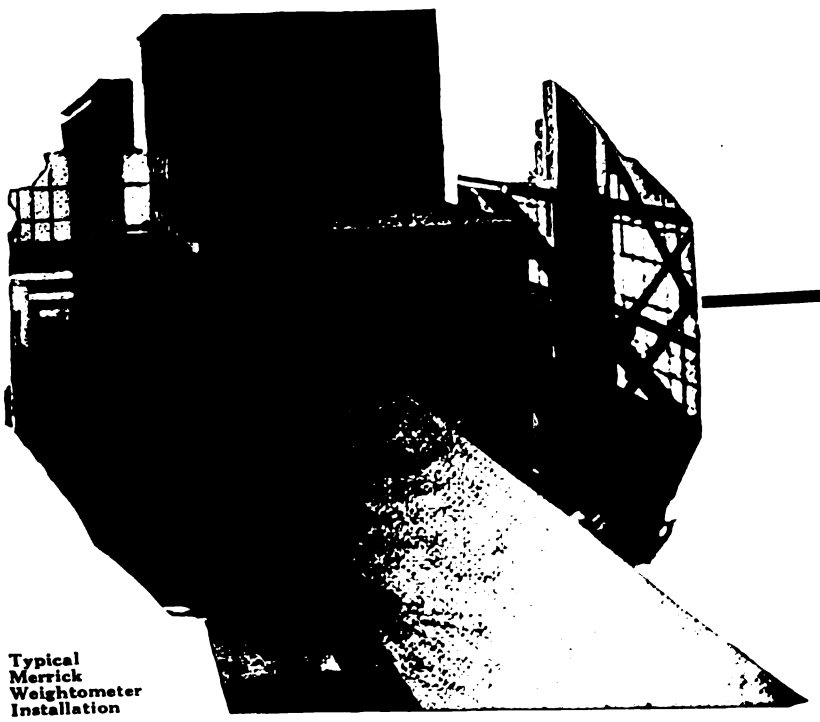
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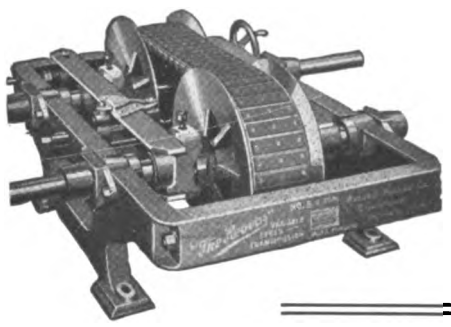
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(Continued from page 30)

years used overhead conveyors or small track trolleys, and who are now investigating the use of tractor trailer trains, lift trucks, etc. Figure 20 shows how a chain with attachments can be used as an aid on the inclined up-haul for elevating sides of beef. The operation is entirely automatic, the carriers releasing themselves from the haul at an offset in the track, and roli thence through a doorway into the building.

Frequently installations of materials handling equipment are condemned because they do not operate successfully, and the causes of these unsuccessful operations are sometimes never investigated. Those given a complete investigation have, in a number of cases, shown that the apparatus was not being properly fed, or the discharge was not properly designed. This has led to the use of special feeding devices for the loading and unloading of elevators and conveyors.

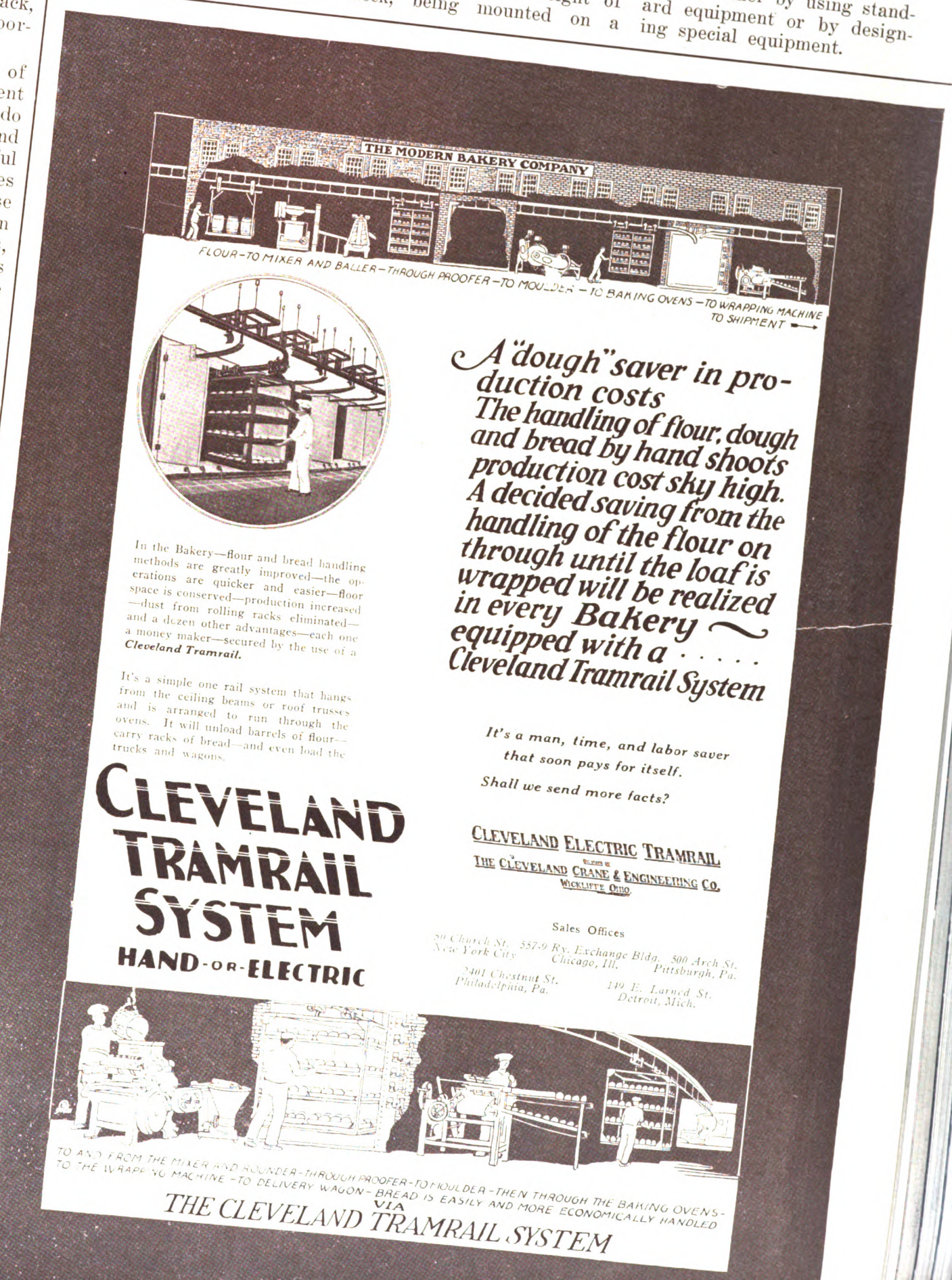
Figure 21 illustrates a self feeding barrel elevator. The feeding conveyor consists of two strands of chain, fitted with pusher attachments, at suitable intervals, for proper barrel spacing. The conveyor is driven by the same motor that operates the elevator, and the timing is such as to deliver a barrel to the elevator as an elevator tray is ready to receive it. By using this feeding mechanism, no empty trays are carried on the elevator run, and there is an assured capacity of eight barrels per minute.

Another and different design is shown in figure 22 for handling rolls of paper to a rigid arm elevator, in one of the largest publishing houses in the world. The rolls are first placed on the stationary fingers, from whence they are lifted by the fingers on the conveyor as shown. The conveyor elevates it to another set of stationary fingers, and at just the right moment, so it will be immediately picked up by the rigid arms of the elevator, which carries the roll between floors. This elevator has a capacity of 90 rolls of paper per hour, varying in length from 32 inches to 68 inches and weighing from 900 to 1,800 pounds.

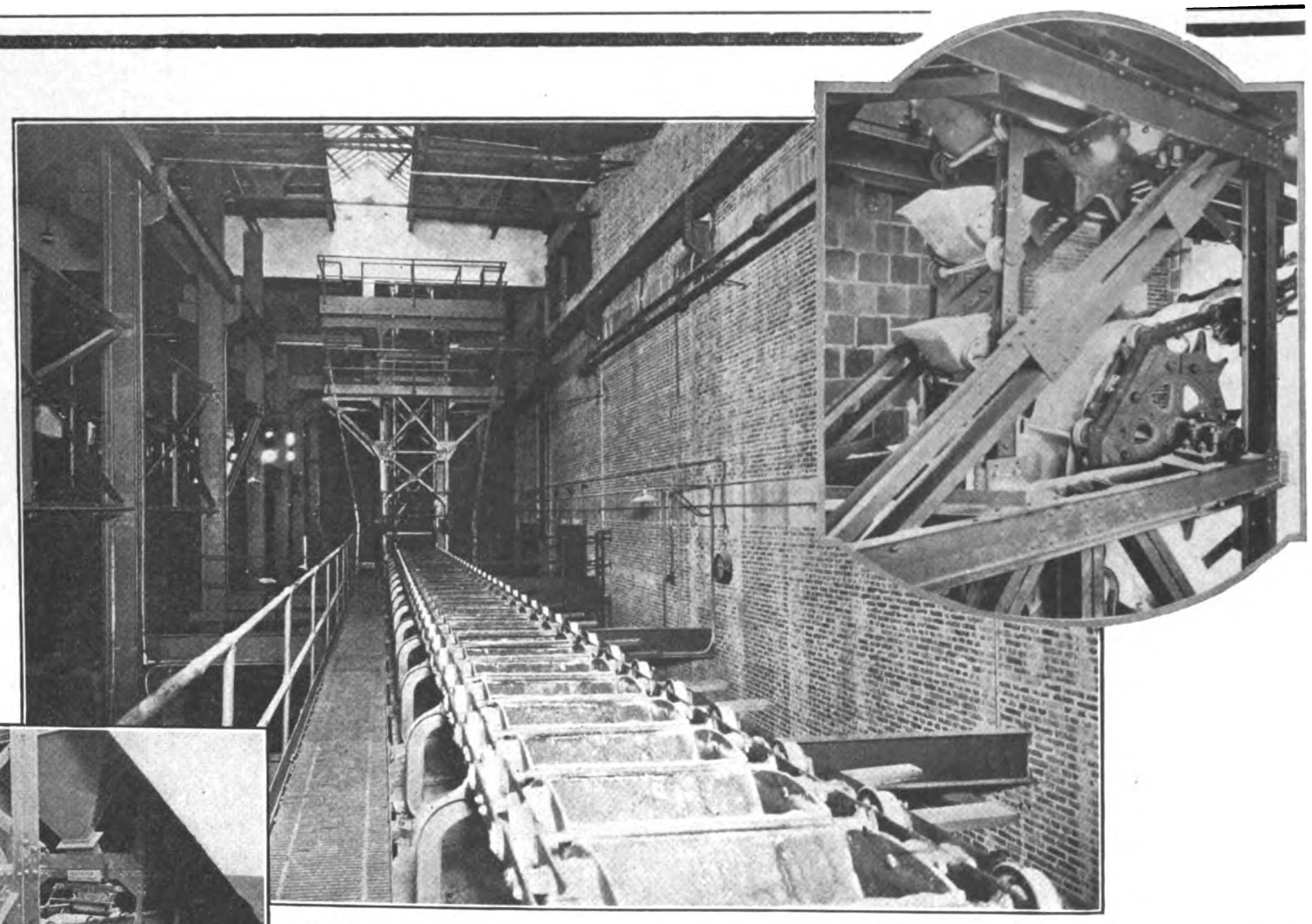
The illustrations show a number of industries that are successfully using this class of machinery, and while the materials handling manufacturers have a large field for their product in this country, they have also developed a use for it in foreign countries, and it might be said that some foreign countries are more progressive in the use of this equipment than we are. For the simple reason that, as we receive immigrants into this country, they lose unskilled labor, due to migration.

Figure 23 shows a portable conveyor, for loading vessels at a port in Australia. This equipment is of American design. It is pivoted in the center, and can be raised at outboard end to suit height of deck, being mounted on a travelling support, that has a longitudinal and transverse movement. It can handle 3,600 bags per hour.

There is no materials handling problem that if put in the hands of the manufacturers or a capable engineer, cannot be solved, either by using standard equipment or by designing special equipment.



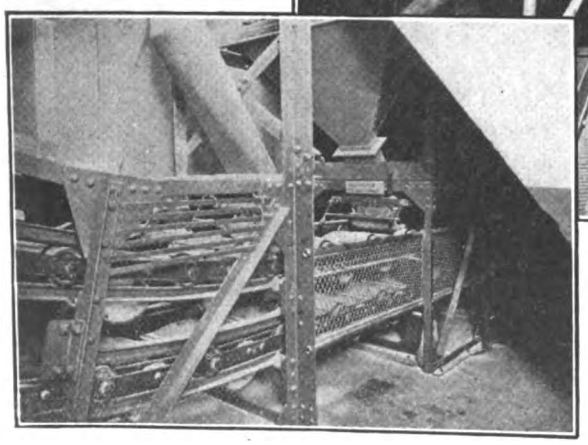
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Upper Insert shows a corner of the aluminum Pivoted Bucket Conveyor.

Lower Insert—From the 2,000,000 lbs. storage bin sugar is drawn off into bags or barrels or fed to the Jeffrey Pivoted ¶ Aluminum Bucket Conveyor.

Center—A Jeffrey Pivoted Bucket Conveyor alternately fills and empties the storage bin containing the raw sugar.



The Aluminum Bucket Conveyor at the American Sugar Refinery Is a JEFFREY

"Hundreds of sugar refiners, chemists, wholesale consumers, engineers, and others interested in the industry, have visited this refinery and gazed in admiration at the many labor-saving and efficiency-producing devices for elevating and conveying such a wide variety of materials——from coal to powdered sugar."

From the Article

"Material Handling in a Modern Sugar Refinery"

by Homer L. Rank, May Industrial Management

The aluminum Pivoted Conveyor buckets—the last word in cleanliness and the first to be installed, described in this article, were designed and installed by The Jeffrey Manufacturing Company. The illustrations tell the story of material handling equipment that greatly help in cutting production costs. Another example of man-power displaced by machinery.

This is typical of the aid given by Jeffrey Engineers throughout industry, in the proper selection of the equipment exactly suited to the conditions.

Modernized conveying equipment will bring your plant to the standard required by the demands of quantity production.

Write us your requirements. A trained engineer-salesman will help you in working out your particular problem.

JEFFREY

Standard Labor-Saving Equipments Include:

Conveyors of various types; Portable Bucket Loaders; Portable Car Unloaders; Portable Belt Conveyors; Elevators; Chains; Crushers; Pulverizers; Shredders; Coal and Ashes Handling Equipments; Skip Hoists; Electric Industrial and Mine Locomotives; Coal Tipple and Mining Machinery, etc.

The Jeffrey Mfg. Co., 946-99 North Fourth St. Columbus, O.

JEFFREY

MATERIAL HANDLING MACHINERY

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The Elimination of Re-handling

(Continued from page 16)

legs. Also pressed steel platforms and structural steel skids are becoming more common. Structural steel and pressed steel construction makes the initial cost high but the maintenance expense is low, and accidents due to collapsing of the legs are unheard of.

Skids have now been developed to handle practically all classes of materials, and thus concerns handle odd shaped and cumbersome pieces that would be difficult to handle in any other way. For example, figure 16 shows a rack superstructure on a skid, for handling axles and other parts of similar shape. In this case, six of these combersome pieces are picked up and transported from one operation to another by the lift truck and its operator, without any other assistance.

Another place where the use of skids is of advantage, is in the handling of heavy castings or complete assembled machines, as in the case of figure 4; by having these machines mounted on skids as shown, it is possible for the lift truck operator to pick them up unassisted, and carry them to various departments within the plant for inspection, or to the shipping room for shipment.

Car unloading and car loading has always been considered a job for hand trucks and common labor, but the use of elevating trucks and skids has materially reduced the cost of this operation, and also makes it possible to unload and load cars much quicker than the old hand methods. Figure 1, shows how the skid on a hand elevating truck can be drawn directly from the car to storage. There is no necessity for re-handling this material and the skid and its load can be placed in storage intact, thus permitting quick re-handling when the goods are taken into the manufacturing process. The correct way to unload a car with skids, is to place three or four empties in the car at the start and when the trucker is taking a filled load to storage, the men remaining in the car simply start to pile materials on an empty skid. After the second or third load, the hand trucker brings more skids so that the men in the car always have skids to pile goods on, and there is no delay.

Figures 2 and 3 show a method of loading cars. The skids are piled with bags directly from the filling machine, and the electric lift truck picks up the loaded skid and transports it directly into the car for stowing. There is no delay to the power equipment because as soon as the skid is placed in the car, it returns for another load. The empty skids are placed outside the car in a neat pile, and on one of the return loads, the truck operator carries them back to the point of loading.

Where it is necessary to move materials by means of trucks, the use of lift trucks and skids will reduce the capital investment and show a savings in labor costs and maintenance costs over platform hand truck methods. If a plant is now using from 50 to a hundred ordinary hand trucks to perform the work, there is no doubt but that two or three lift trucks and from 50 to 100 skids would do it more efficiently, and at less expense. If a new installation is considered, the skid and lift truck method will permit of a smaller investment than would be the case if platform hand trucks were purchased. We will assume that a platform hand truck will cost on the average of $30 apiece, and 100 are required. This would make an investment of $3,000. A well constructed wooden skid in lots of 100, should cost $15 each, or an investment of $1,500. Hand lift trucks of which 3 might possibly be required, would cost approximately $125 apiece, or an investment of $375, making a total investment for skids and lift trucks, $1,875.00. Therefore, in making a comparison, we have

100 platform hand trucks	$3,000
3 hand lift trucks and 100 skids	$1,875
Reducing the initial investment	$1,125.00

(Continued on page 37)



There Is No Economy in Makeshifts

When the output of your machines is placed in Truscon Steel Boxes on Truscon Lift Truck Platforms, you know your production is always moving. There is no economy in handling material on equipment that wiggles and wabbles or collapses in your factory aisles and runways.

It makes no difference if they are white hot forgings or just cold steel; you can't overload Truscon Platforms or Boxes. They won't warp or get out of shape. They smile at abuse.

Whether you use hand or power lift trucks, overhead conveyors or cranes, or any other method of moving material, you will find a Truscon Steel Platform or Box that will carry the load.

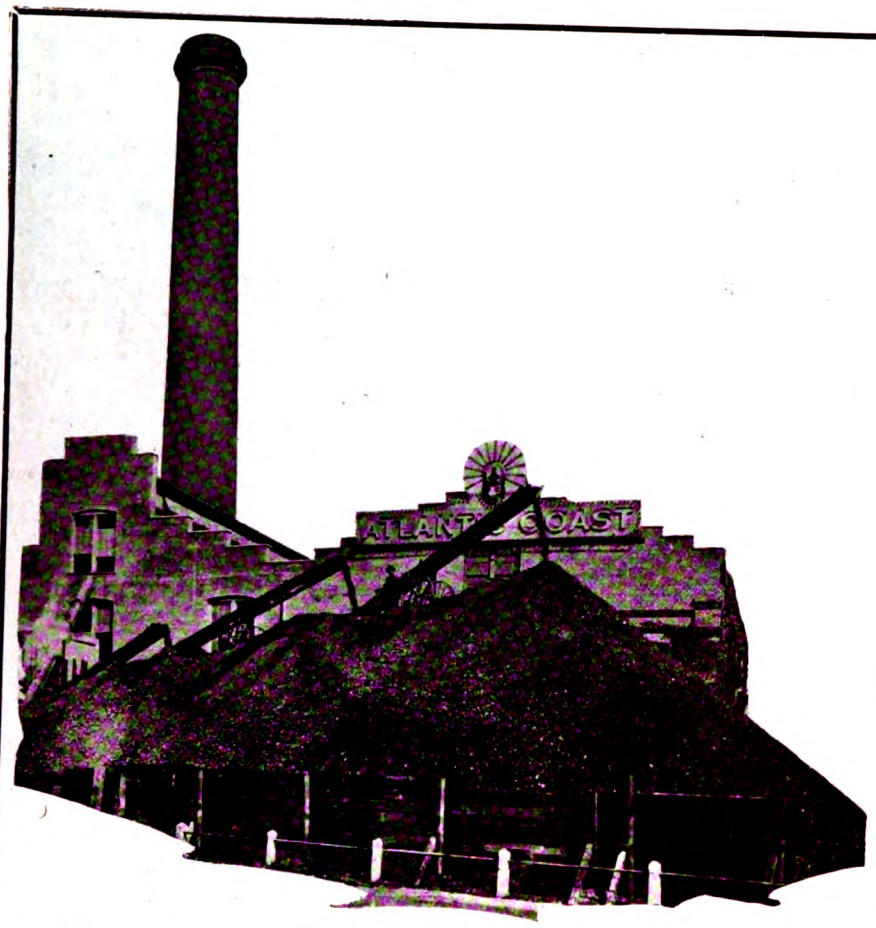
Remember, there is no real economy in makeshifts. Write today and get a line on how Truscon equipment can save you money.

TRUSCON STEEL COMPANY
Youngstown Ohio

Representatives: Chicago, New York, Pittsburgh, Philadelphia, Detroit, Buffalo and Cleveland.

TRUSCON
ALLOY STEEL
PLATFORMS AND BOXES

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Store Your Coal Now

LEARN by your experiences of preceding years, a good pile of coal in storage is your best insurance against strikes, snow storms, car shortages and high prices.

The illustrations show storing coal with the Scoop Conveyor at the power plant of the Atlantic Coast Electric Railway Co., Asbury Park, N. J. These machines unload direct from cars and deliver on this pile. Later in the year the same machines are used for reclaiming into boiler room.

This light-weight portable conveyor is a complete answer to conveying problems at thousands of plants and its first and operating cost is but a fraction of the cost of a more elaborate, but no more capable, conveying system.

You too, can avail yourself of the immense time and money savings possible with this machine.

Write for Catalogue No. 158 Now.

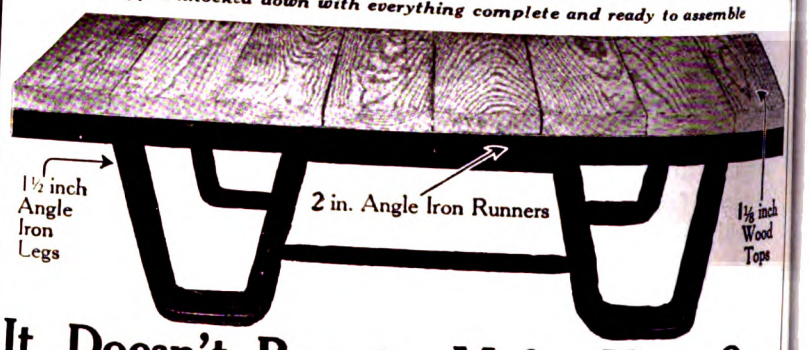
Portable Machinery Co.
PASSAIC, N. J.

ask any user

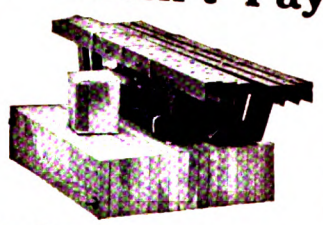
THE SCOOP CONVEYOR



Shipped knocked down with everything complete and ready to assemble



It Doesn't Pay to Make Your Own Truck Platforms



Three Enterprise Platforms ready for shipment, showing why they take a class 3 freight rating.

Made in all Sizes

If you will give us the following information we will quote you promptly on a platform to meet your requirements:

Measurements Desired

Length of top over all . . . . . .
Width of top over all . . . . . .
Clearance between runners . . . . . .
Style elevating truck used . . . . . .
Height of truck base when lowered . .

Important Notice

We ship complete, with necessary bolts, nuts and lock-washers, everything ready to assemble. Top boards of platform finished four sides, cut to length, bored and countersunk for bolts.

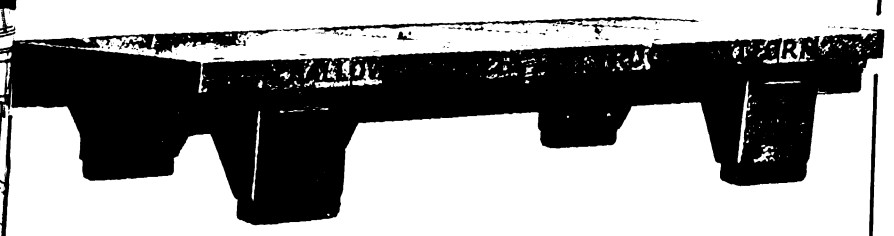
When you can buy Enterprise Platforms, stronger and more durable, that will last indefinitely without costly repairs or replacements. The Enterprise Platform will not break down under heavy loads like all-wood platforms. It is built to stand the most severe usage. In final cost the least expensive platform you can buy or make—less expensive than many in first cost. It is the only combination steel and wood platform shipped knocked down at a low freight rate with everything complete, ready for immediate assembly. Send measurements and get full information and prices.

ENTERPRISE IRON WORKS
1171 E. 24th St. Indianapolis, Ind.

ENTERPRISE PLATFORMS *For Elevating Trucks —Hand or Electric*

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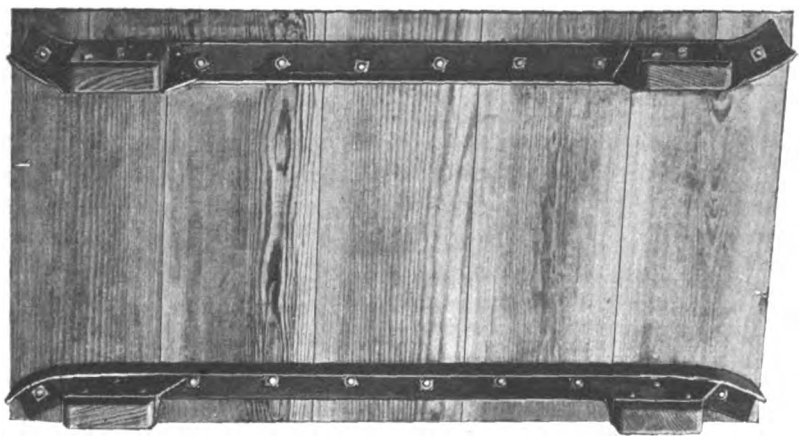
HALLOWELL
STEEL LIFT TRUCK PLATFORMS



Save Renewals and Repairs on Lift Truck Platforms BY USING THE "HALLOWELL"

From time to time the all wooden construction must be repaired, and finally complete replacement is necessary, therefore, the initial investment is only a small part of the ultimate cost.

The robust design of the "Hallowell"—heavy steel angles and steel leg holders being securely joined by hydraulically driven rivets—renders it practically indestructible and, therefore, a very profitable investment.



Ends of runners are flared, as shown by above illustration, an exclusive "Hallowell" feature, which greatly simplifies entering the truck.

The value of this feature is soon realized by the workman after platform is put into service.

STANDARD PRESSED STEEL CO., JENKINTOWN, PA.

(The "Pioneer" Steel Hanger People)

INVESTIGATE

STANDARD PRESSED STEEL COMPANY, JENKINTOWN, PA.
Gentlemen: Kindly send me full details and prices of "Hallowell" Steel Reinforced Platforms.

Name.....

Company.....

Address.....

Truck used.....

(Continued from page 35)

In addition, it is easier and cheaper to maintain the three lift trucks and their mechanical parts, than it would be to maintain 100 platform trucks. However, the savings in first cost is not the only advantage. There is another advantage, that of saving space. When ordinary platform hand trucks are not in use, they require the same amount of valuable floor space as when they are in use. In the case of skids, it is simple to nest them when not in use, so that they can be stored in any out-of-the-way corner of the plant.

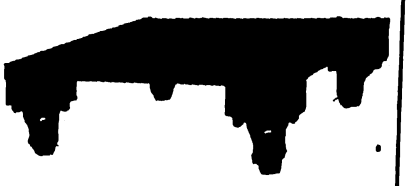
Another advantage of this system is that damage to goods in transit and between operations is eliminated. No matter how carefully goods are handled, and whether they are fragile or machine parts, there is invariably some damage or breakage caused. With racks and special skids, designed to carry finished parts, and by using this system of transportation, the continual handling of parts is practically eliminated, and materials are rarely damaged by the carelessness of the trucker, because the trucker no longer handles them. He simply picks up the entire skid on which the materials are loaded, moves it to the desired location, and sets it down again. No time is lost between operations, no delays or tie-ups of machines waiting for materials to be taken away, or brought up.

In most manufacturing plants, the use of this system of transportation invariably increases production.

The handling and re-handling of sheet tin is difficult and dangerous. In the first place it is heavy and the sharp edges frequently cut the hands of the workers. In the process of making tin into various utensils, it is often handled several times between car and finished product. By using skids and lift trucks, the only time the raw tin has to be handled is at the car, and it can be put in storage on the skids as shown in figure 9. The lift truck can then pick it up without re-handling, and convey it to the point of consumption.

The use of skids is not limited to any industry, and today this type of transportation is

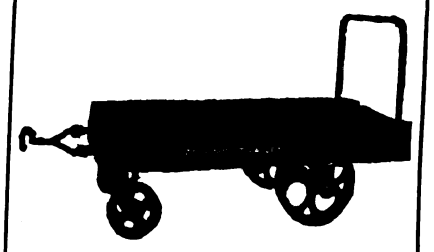
The Lift Truck Platforms that move without the Lift Truck



Time and tide waits for no man—neither do the Zering Live Lift Truck Platforms wait for the man with the Lift Truck. You can move it as soon as it is loaded and avoid delays and lost time on short hauls.

They are made in steel or wood, and are equipped with quick swiveling Zering Ball Bearing Casters. They will move the heaviest loads easily and economically, cutting down your stock in process to the minimum.

Write for prices now and solve the labor shortage problem.



Zering Trailers

Zering Trailers have made a reputation throughout industry for their sturdy construction and dependability.

Tie bolts running the full length and the corners securely locked, prevent the trailer from becoming wobbly or saggy.

Write for full particulars.

The H. Zering Mfg. Co.

4425 Enyart Ave.
(Oakley)

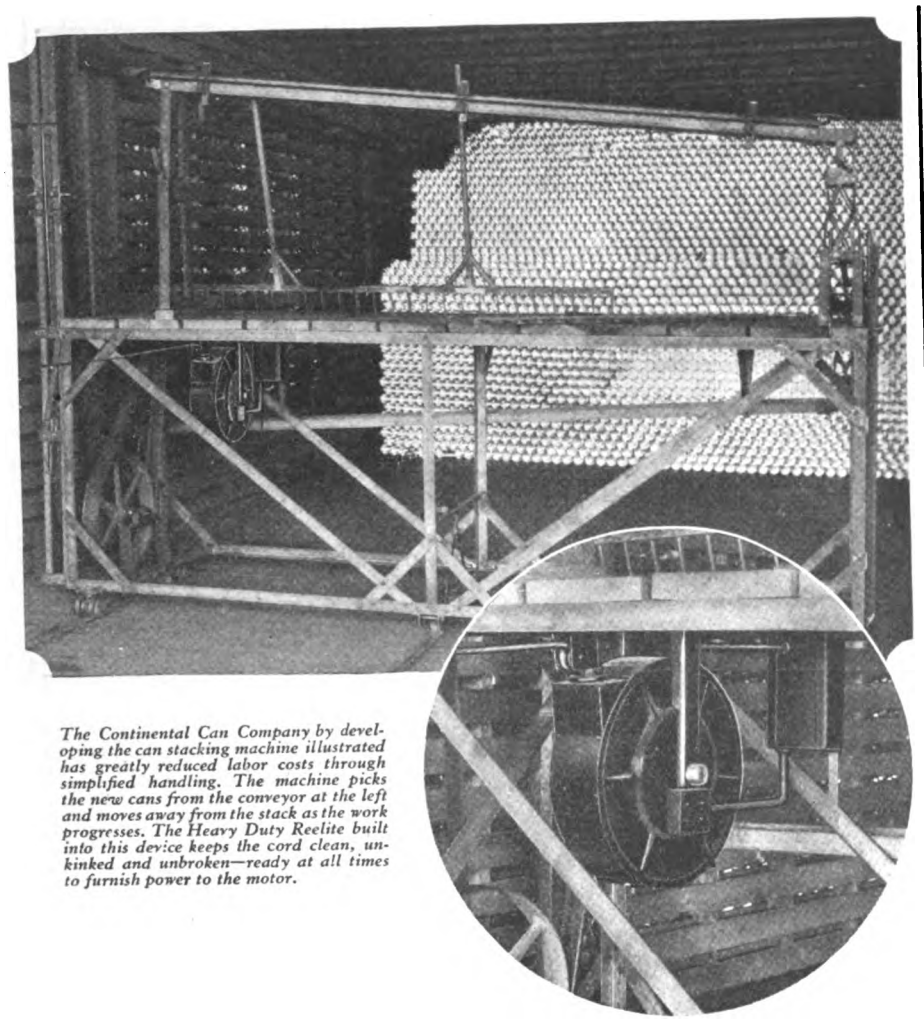
Cincinnati, Ohio

Offices in Principal Cities

Specialists in the Building of Trucks and Trailers

ZERING

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The Continental Can Company by developing the can stacking machine illustrated has greatly reduced labor costs through simplified handling. The machine picks the new cans from the conveyor at the left and moves away from the stack as the work progresses. The Heavy Duty Reelite built into this device keeps the cord clean, unkinked and unbroken—ready at all times to furnish power to the motor.

True Portability for the Portable Machine

The new Heavy Duty Reelite opens new fields for development in portable machinery. This unit can be incorporated in new machines or attached to existing devices to definitely end the worries of portable cord maintenance. There are many situations where bare current conducting rails are not practical from either a safety or operating standpoint. And loose cables dragged over floors, through oil, and under the wheels of trucks always require repair with a loss of operating time for the machine.

The Heavy Duty Reelite pays out cord of practically any size and number of conductors and then automatically retrieves it when no longer required. It is furnished with 1″ male-threaded hubs for mounting on the machine, and knockout for conduit connection for current supply. Our engineers will be glad to give any information or assistance possible in the adaptation of Reelite to your requirements.

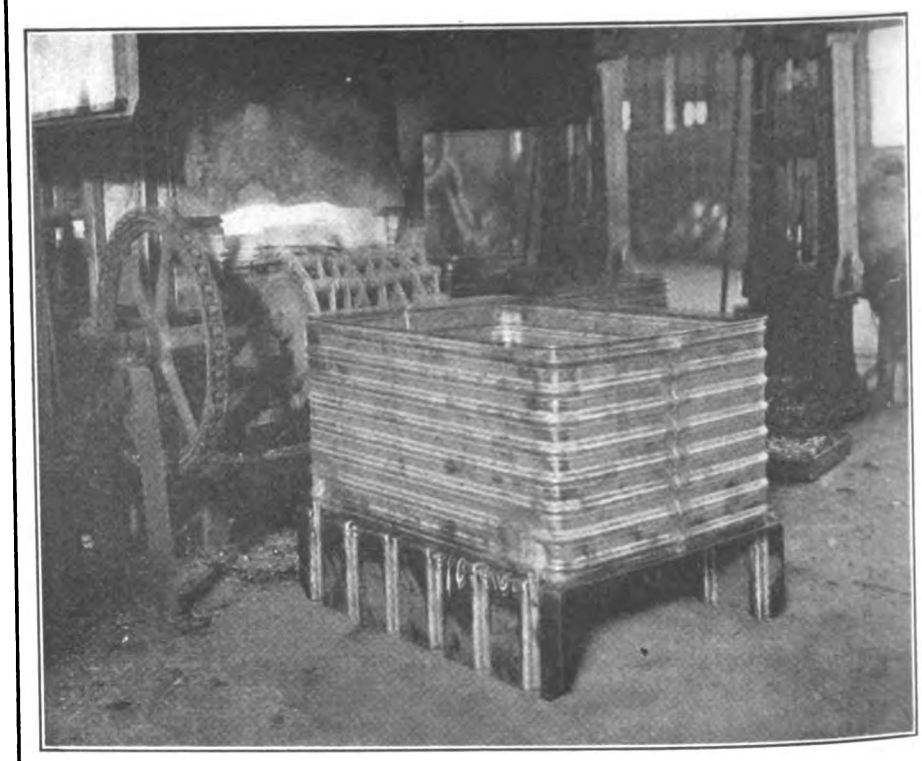
APPLETON ELECTRIC COMPANY
Factory and General Offices
1716 Wellington Avenue
CHICAGO

HEAVY DUTY
Reelite
REG. U.S. PAT. OFF.

used in practically all industries, also in public warehouses and produce exchanges. Chemical plants, tanneries, and places where acid conditions exist, are particularly severe on moving parts, and mechanical equipment. Ordinary platform hand trucks and other types of hand trucks that are required to stand around in these acid conditions, frequently last for only a period of weeks. By using skids, the number of moving parts and trucks is materially reduced, and these trucks can be removed from the acid conditions when not in use. The goods can be loaded on skids, as shown in figure 5, which can be constructed of material of an acid-proof nature, or protected by acid-proof paint. This greatly reduces equipment maintenance costs, and will also bring about the other benefits of reduced direct labor expense.

The length and shape of the load is not always an obstacle to the use of this system of transportation, and many special long or wide trucks have been built to take care of particular installations. Figure 3 shows a special hand lift truck, nine feet long, and handling pipe about 14 feet long. This installation has proved successful under actual operating conditions.

The handling of cores in foundries has always proven difficult, because of their fragile nature, but the use of special rack skids and electric and hand lift trucks is now effecting enormous savings. Figures 20, 21, 22 show the installation of an electric truck in a large foundry. The placing of the rack skid at the core-maker's bench has reduced several handlings in this plant, and the cores are handled only twice, that is, when the coremaker places them on the rack, and when the molder places them in the flask. On other movements, the entire rack is picked up by the truck as shown.



Another advantage obtained by this installation, is a material saving in heat losses, which were enormous with the old type of oven carriage. This carriage operated on a track, and only moved slightly beyond the edge of the oven for unloading. This required the doors of the oven to remain open, and the stored up heat escaped. Now the oven doors are only opened for a few moments, to permit taking out of a loaded rack, and placing a new one within the oven.

Similar rack skids are now being used in concrete block and brick industries, and as many as 500 concrete bricks are being carried direct from briquetting machine to bake oven, as shown in figure 29.

Dump body skids are a recent development, and are now being found in many plants for handling refuse. Frequently these skids are placed at points where refuse is accumulating showly, and at regular intervals the electric lift trucks cover the route, picking up each individual skid, and at the same time, leaving an empty

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NILES CRANES



Save Labor-Save Space —Save Time

with modern crane equipment

A LOCOMOTIVE SHOP is the best example of the place where dependability rules supreme in the choice of crane equipment. The cost of one locomotive is so high that the best insurance possible must be secured. Protection during repairs can only be adequately guaranteed by a 100% reliable crane. One failure is too many. The proof of this reliability lies in strength and sure-fire operation of the electrical equipment and lifting gear. Early comprehension of this fact by Niles engineers has made possible the record for reliability that has characterized Niles Cranes over the long period of years that they have been serving in locomotive shops.

Safety of men and machines demand the best. Niles Cranes entirely fulfill this requirement. They are made in sizes up to 250 tons and larger and in Jib, Wall, Gantry and numerous other types.

For the Steel Mill Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy materials must be handled with speed, safety and economy.

NILES-BEMENT-POND CO.
111 BROADWAY — NEW YORK CITY
CRANE WORKS— PHILADELPHIA, PA.

No. 4 *of a series illustrating the many industries served by Niles Cranes.*

THE TOWMOTOR VS THE LABOR SHORTAGE

THE CHANDLER MOTOR CAR COMPANY
CLEVELAND, OHIO, U.S.A.

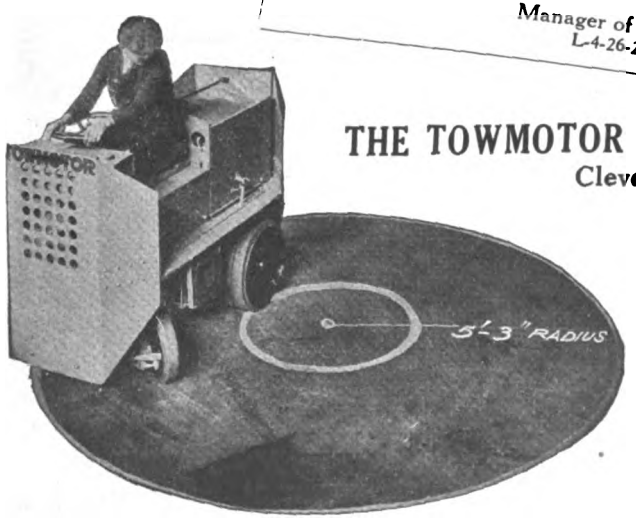
May 1, 1923.

The Towmotor Co.
Cleveland, Ohio.
Gentlemen:

In reply to your letter of April 26th pertaining to our experience with the Towmotor.

We are under the impression that it is the most essential feature in any manufacturing plant. We have no hesitation in saying that our Towmotor has paid for itself many times over, and can accomplish in one day the work of fifty men. Its durability and upkeep under rough usage are more than surprising.

Very truly yours,
THE CHANDLER MOTOR CAR COMPANY
Signed: J. W. Whitehouse
Manager of Service.
L-4-26-23



THE TOWMOTOR COMPANY
Cleveland, Ohio

in its place. This is easily accomplished by having one o more extra empties with wh to start the endless chain empty is placed at the point, and the filled skid is tak en to the dump. On returning, the truck operator has an empty skid which he takes and places at the second point, removing the loaded skid. Thus, he never returns to the same point twice, unless it is required to remove two skids.

In machine shops, where small gears, cams, etc., are manufactured, as well as in the manufacture of phonograph and armature discs, the use of spindles mounted on the skid platform, (Fig. 17) prevents the load from slipping, and eliminates damage to the products. If the products are not so highly finished, or if they are rough castings, a box section which can be mounted on the platform, will be found more economical, because it can be dumped more readily, and will frequently hold more material.

Figure 15, illustrates a collapsible rack or box section, for use with platform skids. This collapsible section permits empty skids to be stored in very small space.

While the majority of illustrations show skids with permanent legs, the advantage of live or caster skids should not be overlooked. By having the skids equipped with a full size set of wheels, two of which, or four of which, can be swivel, so as to permit turning, many advantages are acquired, and it is possible for machine operators to move the loaded skid for short distances when hand trucks or electric trucks are not available. It also makes it easier to move a skid out of the way in case it is obstructing the aisle or a piece of machinery.

Another idea which is not shown in the illustrations, but which is of decided advantage, is a skid with legs so designed that a lift truck can approach it from one of four sides when lifting it and not make it necessary to approach it only from one of two ends. The writer does not know of any standard skid that permits this. He has, however, been in plants where the engineering department has developed such a skid and manufactured it in

(*Continued on page 41*)

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HAND OR ELECTRIC TRUCKING?

Time has nearly passed for choosing.

ELWELL-PARKER

Electric Industrial Trucks and Tractors

are available now

but common labor is not

ELWELL-PARKERS

lift, carry, and place the loads where wanted.

They will deliver eight times the load at three times the speed of a hand trucker.

They are always ready, work early and late. Many operate 23 hours per day.

60% of all handling can be done by these units. May be driven practically any place a hand truck can be pushed.

Thousands in operation in over 200 branches of industry in 23 different countries. Tried and proven equal to every inside haulage requirement. Many have been in continuous service for over 10 years.

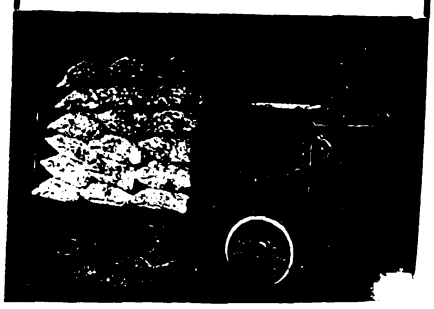
ELWELL-PARKER

trucks are guaranteed to save from the very start.

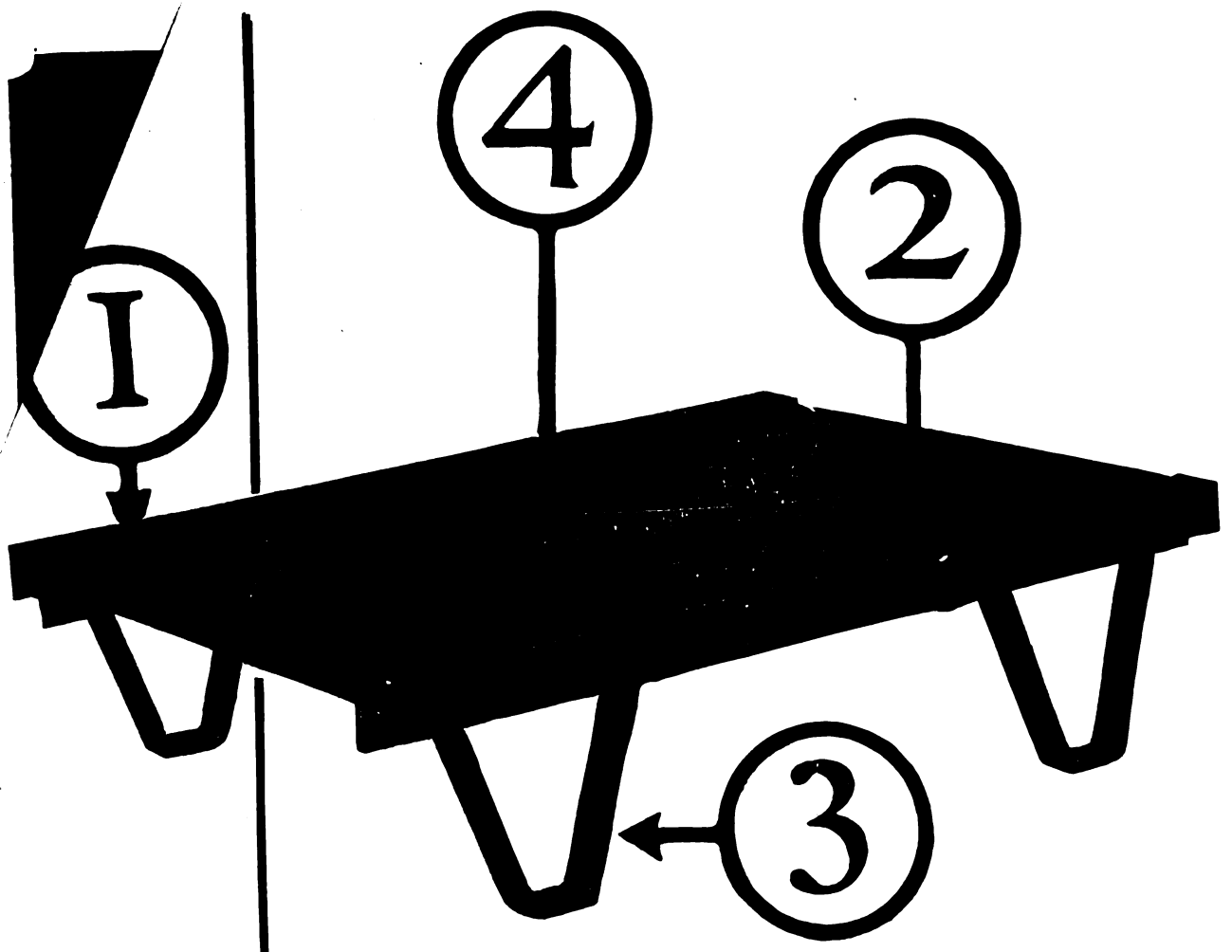
SELF-LOADING TRUCKS
DUMPING TRUCKS
CRANE TRUCKS
LIFT TRUCKS
TRACTORS

Our unobligating survey is yours on request, or ask for Bulletin 51.

ELWELL - PARKER
ELECTRIC COMPANY,
CLEVELAND



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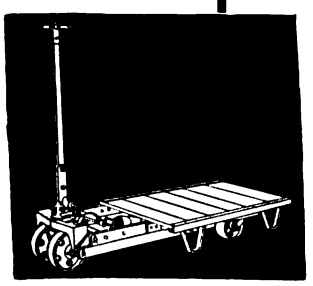
1 ***Steel-Bound the full length.*** Powerful clamping prevents sagging. Strongest where ordinary platforms are weakest.

2 ***Forged steel bolts*** with large heads anchored in the steel rails clamp oak top, side rails and steel legs together in a vise-like grip.

3 ***Forged steel legs*** support heaviest loads indefinitely. Won't wear down or wabble. Broad smooth surface prevents damage to floors.

4 ***Oak top,*** of selected wood. A wear-resisting surface that protects fragile materials from chipping and holds machine products from slipping.

Stuebing "Steel-Bound" Platforms at most unheard-of low prices!



Stuebing Steel-Bound Platforms match the Stuebing Lift Truck in strength of build and adaptability of service. They won't wear down or wabble

There are two reasons why we can now quote most unusually low prices on Stuebing "Steel-Bound" Platforms: (1) *Increasing production* and (2) *Standardized sizes.*

The increasing demand for "Steel-Bound" Platforms is the natural result of a conviction, on the part of users of lift truck systems, that it doesn't pay to use cheap platforms.

The development of standardized platform sizes results in manufacturing economies, permitting us to fill 90% of industry's needs at considerable savings.

For instance, genuine Stuebing "Steel-Bound" Platforms can be had for

$4.83 each *f. o. b. Cincinnati*

This platform is a most popular size—30 in. wide x 36 in. long x 6½ in. high. Other standardized sizes, covering a wide range of widths and lengths, can be had at proportionately low prices.

Don't "make the best of it" with wooden platforms, or other types that aim to equal "Steel-Bound" design. *There is only one "Steel-Bound" Platform—and it is made by Stuebing. It was originated by Stuebing to bear loads carried by Stuebing Lift Trucks. It is fully patented!*

Write for table of standardized sizes and advise us what size platforms you are using. We can save you money.

The Stuebing Truck Company

Cincinnati, Ohio **Montreal, Quebec**

StueBing

LIFT TRUCK SYSTEMS

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(Continued from page 39)

their own shop. In each instance, the use of such a skid has been found successful, even on heavy loads.

In building a super-structure for carrying special parts, or in designing special skids, the lower platform and legs should not be changed, but should be standard equipment, and the super-structure should be in the form of an attachment, so that in case of necessity, it can be removed without damaging the entire skid. This method also permits replacement at a small expense, in case the lower part of the skid is damaged when in operation.

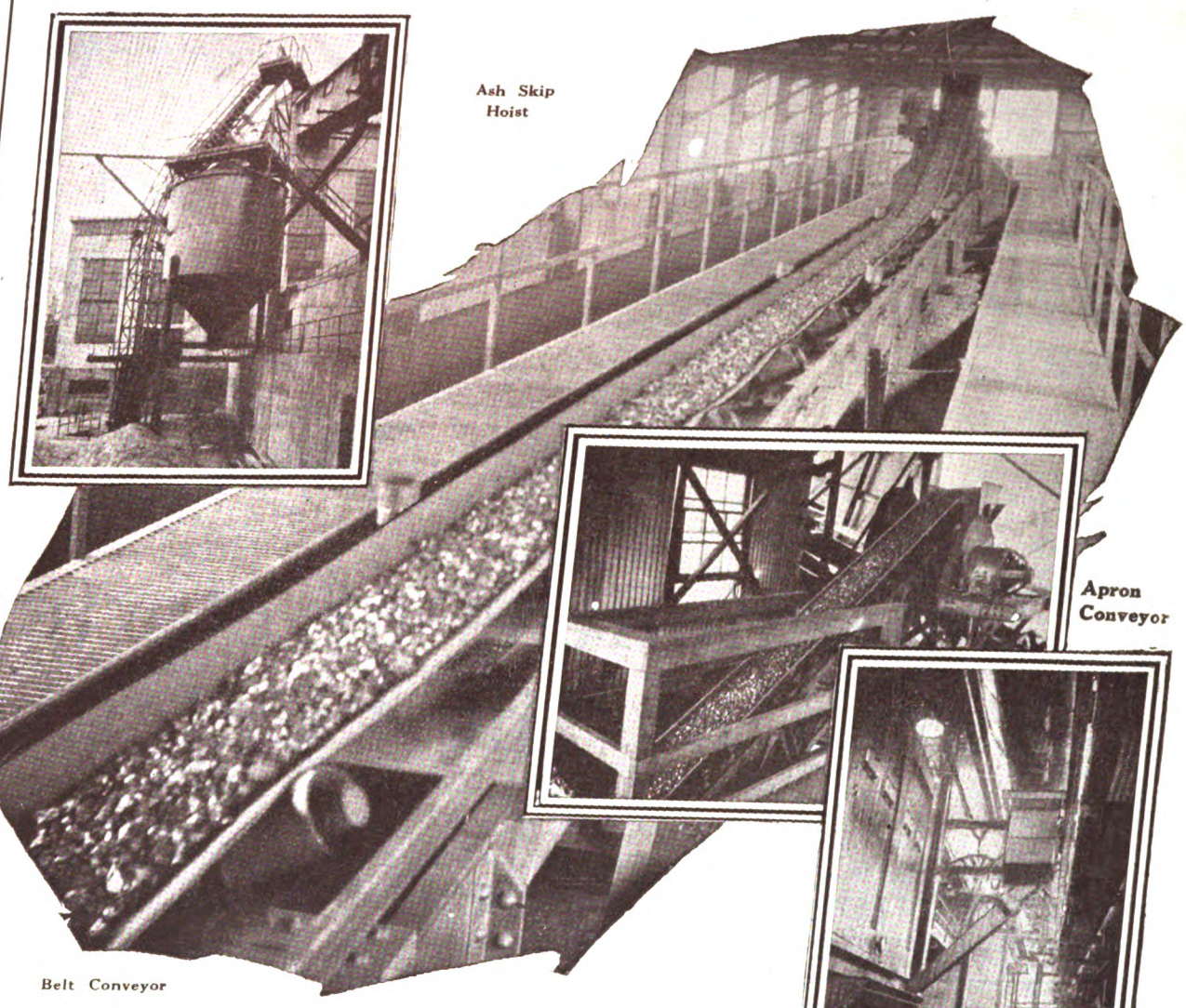
Figure 8 shows pressed steel skids, and this construction is becoming more common due to the practical indestructibility of this type. At the present time, they are being used mainly in heavy machine work, but as the advantage of low maintenance costs is being realized, they are slowly being put in other industries, and on operations where lighter skids are now being used. It is a simple matter to equip these skids with special super-structure, the same as the steel and wood construction skids are equipped with special super-structures for handling various kinds of materials.

It will be seen from the illustrations that it is possible to develop a skid for practically every material, and for every industry, and these are only a few of the many types that are now operating successfully.

Some machine operations, as shown in figures 18 and 19, make special provision for holding the skids so that the material can be loaded direct from the machine to the skid without the necessity of re-handling. It is a well-known fact that the paper industry caused the development of the platform lift truck idea of transportation, and it is therefore interesting to note that this ingenious device shows the way of handling finished paper on skids direct from the finishing machine.

The secret of a successful installation is few trucks and many skids. The plant manager who tries to lessen the number of skids, is only reducing the efficiency of his system. Lift trucks whether hand, electric or gasoline, cost considerably more than old type hand trucks, and for this reason should be kept continually busy. In the majority of cases, the complete system should include both power-driven and hand-propelled trucks so that the long hauls can be carried rapidly by power, and the short hauls by hand trucks. If there are a number of short hauls, it is frequently more advantageous to install a power-driven truck than several hand trucks, the reason being that although the initial expense is higher for the power-driven truck, it will reduce the number of men required if hand trucks were used.

The use of skids and elevating trucks will mean a change in handling methods, and executives should not expect this equipment to operate under the same methods employed when platform hand trucks were used.



Turning Labor Losses into Dividends

Your Board of Directors are continually looking to you for a saving in operating costs in your Power Plant. One of the biggest items charged against operating expense is labor. By cutting down labor costs you automatically reduce the operating expense. This means increased earnings—dividends.

Webster Equipment is designed to cut labor charges to a minimum. Perfection in design and rugged construction makes this possible. Our Engineers have given years of study to the proper handling of coal and ashes in power plants. They stand ready to assist you in the correct selection of equipment to meet your particular requirements.

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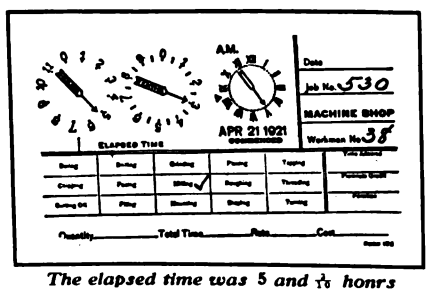
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JONES started Job 530 on a milling machine at 8:24 A.M. and finished at 2:12 P.M. Allowing 30 minutes for lunch, how long did he work on that job?



The elapsed time was 5 and ⅓ honrs

In a department of 50 workmen averaging four jobs a day and whose time records are written by the workmen or a clerk more than two solid months (8 hour days) of time and labor will be required in a year merely to substract the starting from the finishing times, allowing only 30 seconds for each operation.

Think of the huge economic waste in a factory of several departments and hundreds of workmen. This can be entirely eliminated by using THE CALCULAGRAPH, the the *Elapsed Time Recorder.*

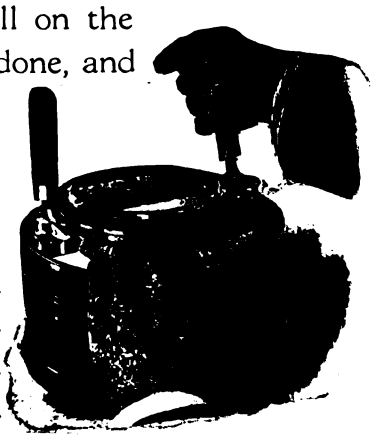
The Calculagraph makes an original printed record of the start, finish and actual *elapsed time* of every job.

It saves labor.

It furnishes accurate records for labor cost and payroll.

It increases production.

And above all it is simple to install and operate. One backward-forward movement of the right-hand lever when the job starts, a pull on the left hand lever when the job is done, and the time record is complete.



Calculagraph

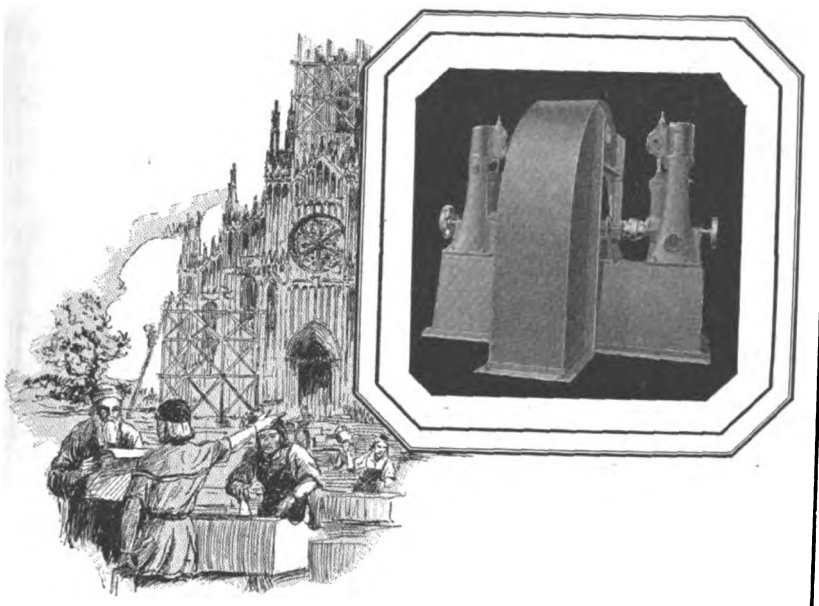
"Elapsed Time Records"

This is the title of a booklet which contains valuable time-keeping information. Those interested in labor cost and payroll records may have a copy upon request.

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Where perfection is the aim

THERE is something in a manufacturer's pride in a product—an old spirit that has come down from such men as those who built the cathedrals of old Europe—and we believe that it is more apparent here at the Clarage works than at most plants.

To many this would seem an idle boast but nevertheless it is so.

Here the utmost care is taken to eliminate the sl p-shod workman and the hurry-up, let-it-go-at-that methods that destroy the refinement of the product. Here the smallest operation is not slighted but from the drilling of a hole to the hanging of a wheel careful inspection assures absolute accuracy—a reason for the long and smooth operation of Clarage Fans and Blowers.

Here the Industrial Plant Manager will find the solution of many of his troubles. Such problems as the economical moving of light materials, ventilation, drying, cooling, heating, and forced draft have all been successfully met at one time or another by Clarage engineers.



Here he can buy a fan or blower knowing that he will get the best that careful supervision and modern equipment will build—a unit for which we are personally responsible.

CLARAGE
FAN COMPANY
FANS~BLOWERS~EXHAUSTERS
KALAMAZOO

Clarage Fans are built in types and sizes for every service.

Cost Accounting in the Lumber Industry

(*Continued from page 17*)

phases of the system is that it would have cost these 250 millmen from $500 to several thousand dollars each to have such a system devised and installed. The Association, however, furnishes it without charge to its members, and sells it complete to non-members for $25.00, also providing the required stationery at cost. The saving in accounting fees alone has amounted to over one hundred thousand dollars, while the indirect savings effected by the uniform and accurate methods adopted as a result of the cost system, amount to many times that figure.

The millman of the early 90's was usually a broad, powerful, hardhitting lumberjack. Saving a few hundred dollars from the annual sprees where most of the "piles" were dropped, he invested in a second-hand sawmill, obtained some timber-cutting rights, or stumpage, and literally "hung up his shingle." From the earliest days, the decay-resistant red cedar furnished an important source of revenue.

What did "big Bill" Stevens want with a set of books and a lot of "figgers"? He knew timber and how to scale it roughly on the stump. His fallers and buckers and sawyers knew how to convert the standing tree into salable plank, boards, lath, shingles and finished lumber. Buyers sent in their orders fairly regularly. If at the end of the week there was enough in the strongbox to meet the current payroll, cover the "grub" for the next week, and perhaps buy a new buzzsaw, he was "sitting pretty."

With the coming of the small town, he moved his limited surplus to the bank. If some week a forgotten note came due, he grabbed a few bills from the rough fir desk, hied himself to the bank, and was tided over the crisis. But the day came when even bills of lading did not bring the necessary cash. Then came the income tax man, with his skeptical eyes on the ink-stained returns of "Big Bill."

(*Continued on page 45*)

Where Machines and Operators Develop Together

under close watch of the work turned out

Your machines are developed, as your *men* are developed, by following up every improvement that registers in a higher rate-of-work.

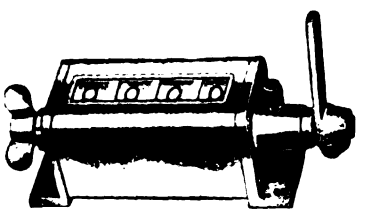
Production-records show you the trend toward efficiency or away from it. And by that very fact the only outcome is an increased *OUTPUT*—where you employ

Veeder COUNTERS

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable to experimental work. If run backward the counter subtracts. Price $2.00. (*Cut 3/5 size.*) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also $2.0

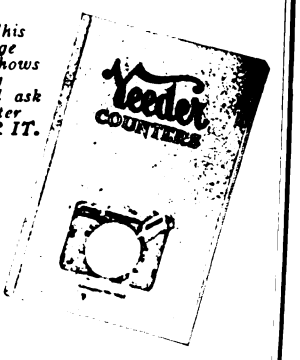


The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price, with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter to record reciprocating movements as on punch presses, $11.50 (list).

FREE—This new 80-page booklet shows everything you could ask in a counter ASK FOR IT.



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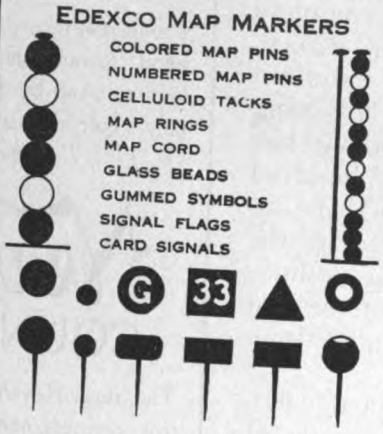
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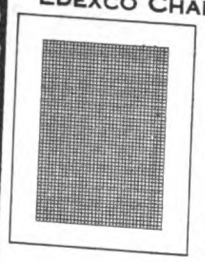
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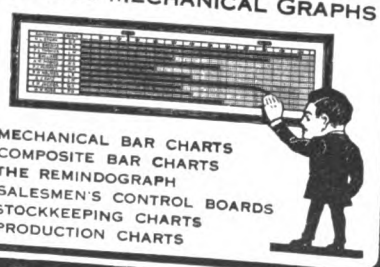
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—by the use of the Multiblasters. In this time he can give that entire area a thorough coating equal to two or three coats by brush! And aside from the time saved by eliminating the extra coats, the "man behind the gun" operating a Multiblaster can do six times as much painting as a brush worker.

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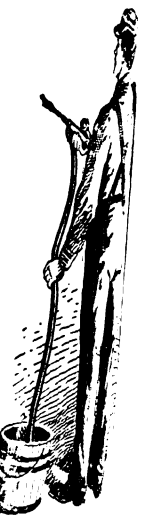
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(Continued from page 43)

Hard times, low prices, and lower demand, have gradually eliminated most of the "Big Bill" type of millmen. Those who weathered the storms did so by studying their operations, eliminating wastes, and above all else, recording the facts concerning their business. The despised "figgers" are often today the direct means of converting the banker's "NO!" into a less emphatic but more relieving "Yes!" And not infrequently that has been the difference between closing down or "turning over."

Then, too, the larger operators came into the field, and with modern machinery for handling and milling, set lumber prices which the less productive could not meet. Ability to keep operating and meet bills, even in "hard times," is a powerful argument, and millmen have come to respect the ledgers and journals studied so intently by the banker.

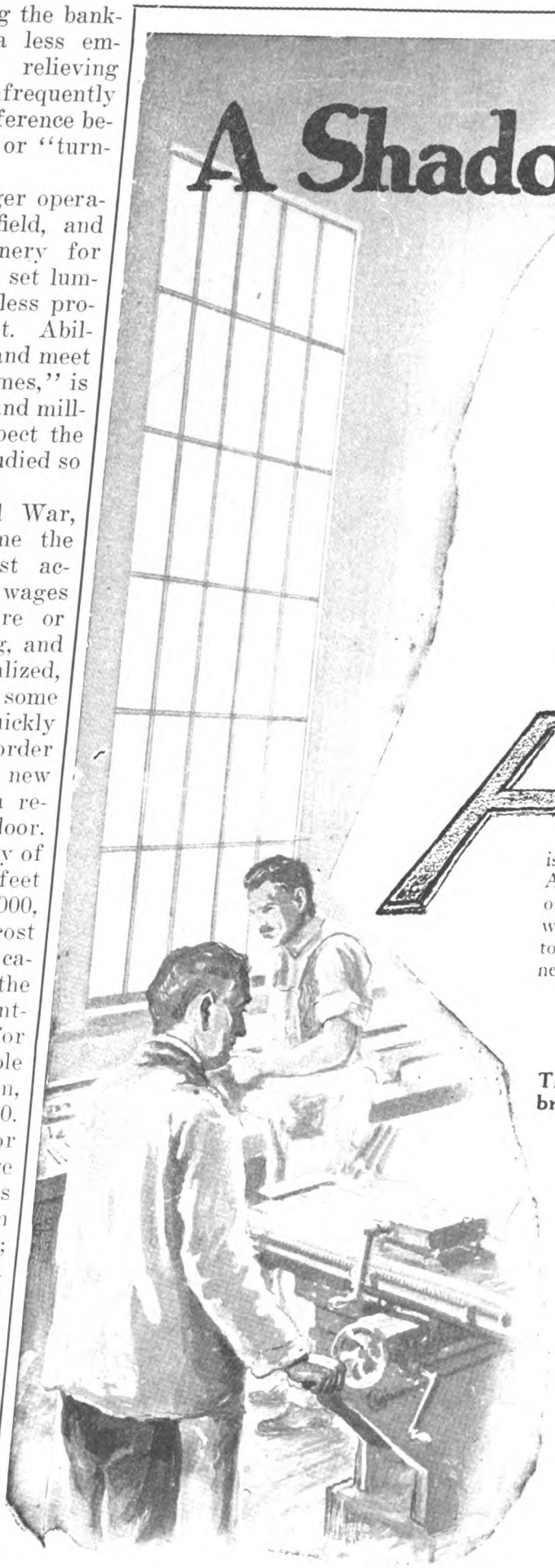
It required a World War, however, to bring home the pressing need of a cost accounting system. With wages skyrocketing, prices more or less reluctantly following, and costs completely demoralized, the millman had to have some means of finding quickly whether the "big foreign order just received" meant a new lease of life, or merely a receiver's sign on the office door.

The mills vary in quantity of lumber cut, from 10,000 feet board measure, up to 500,000, or more, per day. The cost problem for mlls of 50,000 capacity and up, is largely the same. For such mills, accounting and engineering service for installing an accurate, simple yet adequate cost system, would rarely be less than $500. At that price, few mills prior to the war had the knowledge of their costs which the times demanded. However, western manufacturers learn rapidly; the lessons of economy taught in the school of coöperation are being applied as never before.

Stabilization of the industry in this section inevitably leads to lower lumber prices. Even today the western mills go directly into the territory of other lumber producing regions and undersell many of their competitors. But there is a reasonable lower limit of prices. If Bill Stevens, down at Kelso, Washington, unwittingly sells his output for ten per cent. less than it costs him, it is decidedly troublesome for everybody, until the banker or the receiver steps in.

The Association's Committee on Cost Accounting was composed of experts: four practical lumbermen, three certified public accountants, and an industrial cost engineer, all of whom were experienced in lumber accounting. Such an array of "figuring" talent was never before assembled in the West. For eight months this committee studied every angle of lumber costs, from the scaled "log feet" in the lofty evergreen to the 75 or more items of the sawmill: the boards, plank, flooring, lath, shingles and other finished product. When work was completed the cost was approximately $15,000; but the committee had designed a system which will endure as long as trees are felled in this country. Even in the Pacific Northwest, this will be a long time

(Continued on page 48)



A Shadowless Factory

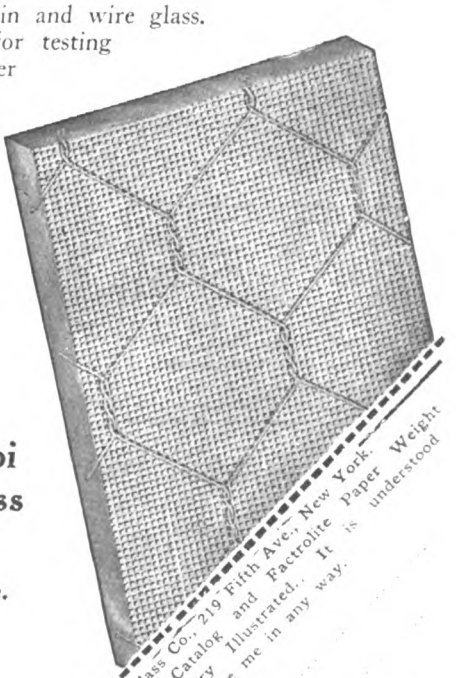
A big Government building 700 x 300 ft. was recently daylighted by over 100,000 sq.ft. of "FACTROLITE." In commenting upon the quality of the daylight *diffusion* in the big structure, engineers remarked—"You cannot see a shadow in any part of the building."

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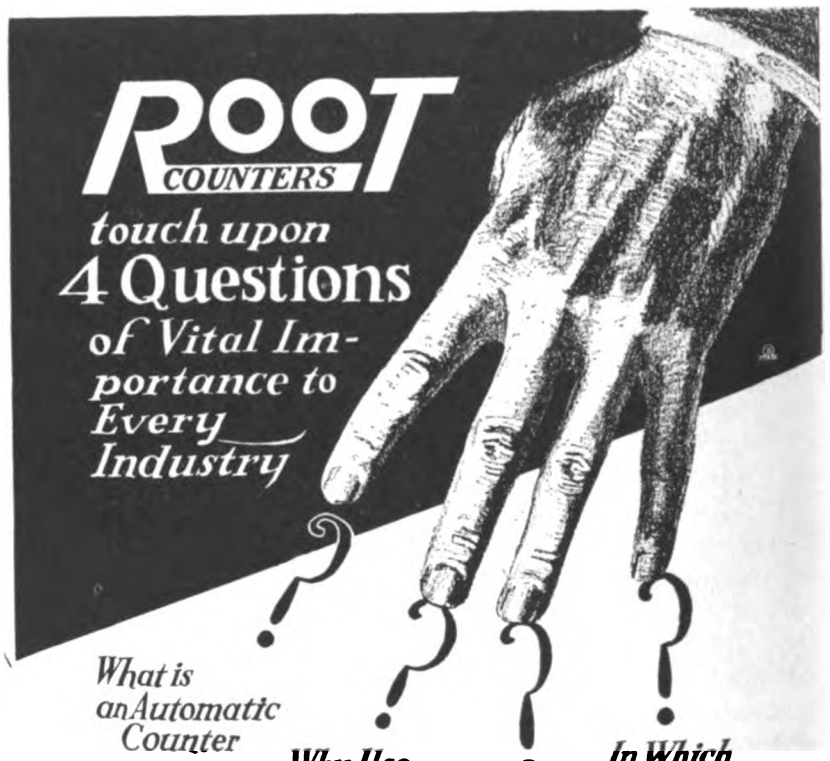
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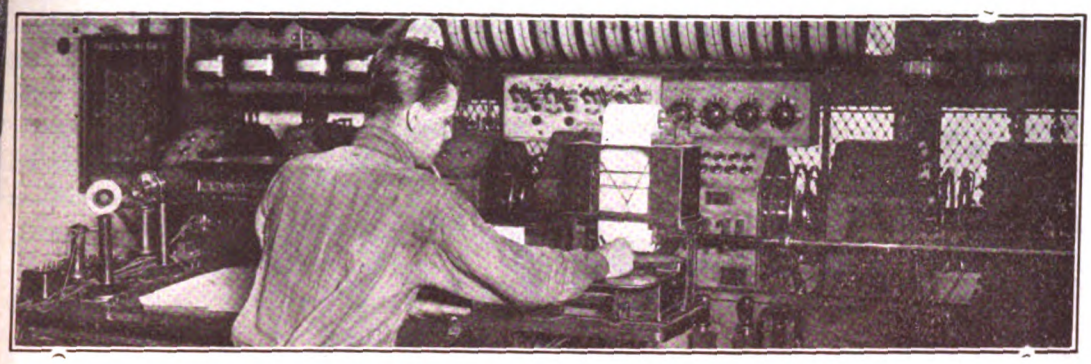
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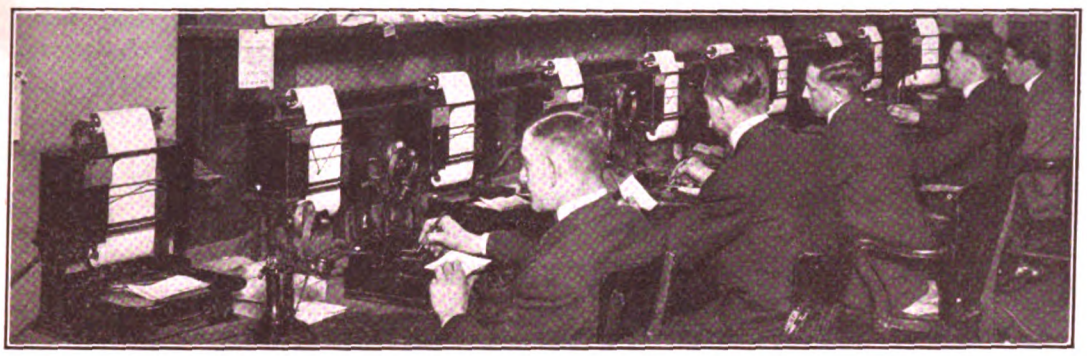
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(*Continued from page 45*)

indeed, at least fifty years, depending upon one's conception of the future building industry and its demands. Then, too, it is only a question of time until reforestation will be undertaken on a quantity scale.

Fifteen thousand dollars is quite a sum of money, even with the fifty-cent dollars of these depreciated times. But some 125 mills have adopted the cost system in its entirety, and 125 others as a groundwork, which with the new installations being made daily, will make the actual cost, in four years of operation, less than $50 per mill.

The Association has evidently looked forward to even wider application of its system, for it has set the full price of the Manual, containing all the principles of the system, at only $25.00 to non-members; members receiving the Manual free on request. Forms and stationery being supplied at cost, there has been effected a saving, in accounting fees alone, of more than $100,000 in the 400 mills which eventually may be expected to adopt the uniform plan. That amount is not to be sneezed at, since every consumer of wood products must eventually pay the cost of production, and this saving is reflected in lower prices as well as a stabilized market. The Association places orders for ledger stock by the 100,000 sheets, and estimates that it saves the average millman 50 per cent. of his cost by small order lots.

One Field Man, the industrial cost engineer who assisted in devising the system, is kept constantly traveling to mills desiring assistance or information on the uniform system. This man, C. D. Moore, formerly with The Emerson Engineers, is the only technical assistance required, so well has the cost system been designed and so carefully explained in the Manual. No extra clerical assistance is required by this system, outside of the normal force.

What does the Uniform Cost System accomplish, to merit the pride with which it is referred to in the Seattle offices of its creators? Summarizing from "The Bible," otherwise known as the Manual:

It is built up upon correct accounting practice and sound economic principles.

General use of this system will result in accurate reflection of fundamental conditions.

It enables millmen to deal intelligently with the labor problem.

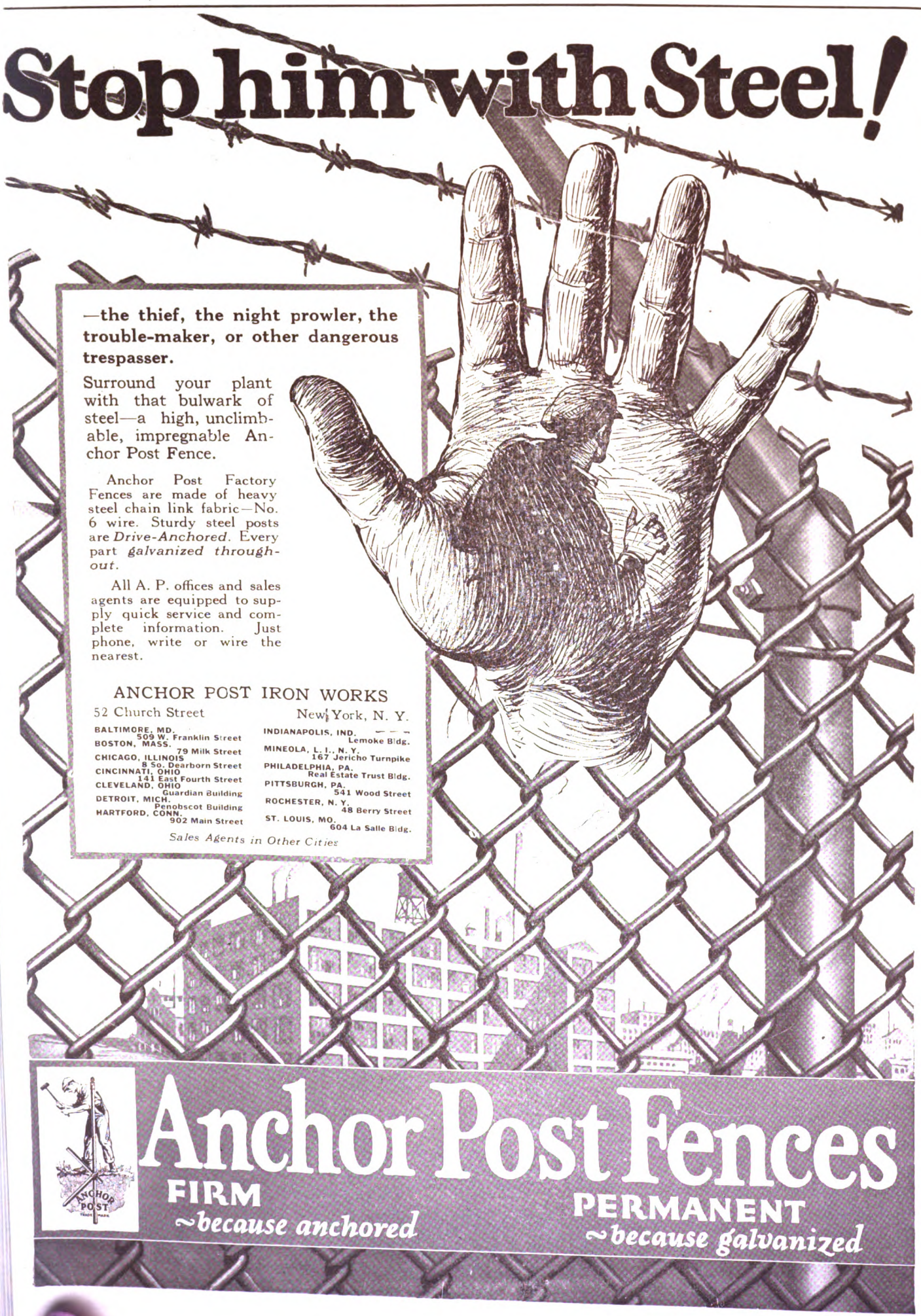
It eliminates guesswork from month to month as to the final outcome of the year's operations in the profit and loss statement.

Each concern is enabled to compare its individual costs, even the detailed 62 operations of the larger mills, with all other reporting concerns, and thus discover abnormally high costs, which can usually be reduced.

Each concern can determine its results of operating, financially as well as physically, especially necessary for income tax and other reports.

"Correct accounting methods and proper authenticated reports have meant much to

(*Continued on page 50*)



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Rectigraph

PHOTOGRAPHIC RECORD PAPER

For Copying Machines

PRICES REVISED DOWNWARD

THE RECTIGRAPH COMPANY manufactures its own photographic copying machines and coats its own photographic paper, the entire plant being devoted exclusively to this line. Due to a lowering of the prices of some materials and economies effected in our new plant, we are enabled to announce normal prices on Photo-copying paper.

PRICES ON RECTIGRAPH PAPER

REGULAR WEIGHT MATTE SURFACE
Rolls 350 Feet Length

8½ inch width	
9½ " "	$10.68
11½ " "	11.93
12¼ " "	14.00
13 " "	15.45
14 " "	16.00
15 " "	17.59
18 " "	18.84
18¼ " "	22.00
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GLOSSY SURFACE
Rolls 250 Feet Length.

8½ inch width	
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12¼ " "	19.60
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	30.00

RECTIGRAPH emulsions are coated upon a high grade 100% rag stock, producing excellent results with a durable base. Rectigraph paper is a contrasty bromide paper, with excellent orthochromatic qualities, and will reproduce colors perfectly. All the speed consistent with good quality.

The RECTIGRAPH COMPANY has always regarded acceptance of an order as a pledge that it would be filled at the earliest possible date. The output of our plant belongs to our customers with orders on our books. This policy compelled us, during the past few years, to decline much desirable business which would have been highly appreciated, but this could not be considered without prejudice to previous connections. Improved facilities in our new plant enable us to increase production and quality and to decrease manufacturing costs. OUR CUSTOMERS WILL BENEFIT.

It is to your interest to become acquainted with Rectigraph Paper. We would be glad to receive your order for a sample roll, spooled to fit your photographic apparatus. You can then judge of its merits.

Rectigraph Company

(An Independent Corporation)

ORIGINATORS OF THE PHOTO-COPY MACHINE
ROCHESTER, N. Y.

MEECO SANITARY DRINKING FOUNTAINS

are

Practical, Tangible Assets in the Modern Factory

—

We guarantee their durability and efficiency.

—

Let us send you proof of their economy in both first cost and operation.



Chairs and Stools Lockers]

METAL MEECO PRODUCTS

Sanitary Washbowls Shelving

Manufacturing Equipment & Engineering Co.

Originators and World's Largest Makers of Ice-Cooled Drinking Fountains

Framingham, Mass.

MEECO COOLERS



Here's a LAY Broom in use in the D. M. Goodwillie Co.'s plant at Chicago, where it is called upon many times each day to handle fine sawdust heavy shavings and chips and Dents' oil soaked sawdust.

The strong, firm, well-balanced construction of the proper kind of materials takes care of the job with ease.

No matter what kind of refuse you have to sweep the LAY Broom will sweep it cleanest.



HERE'S A BETTER BROOM

That Will Give You More Service Than Any Other Broom of the Same Weight on the Market

Put this Lay Broom at work in your plant alongside of any other equal-weight broom you can buy. Watch them day after day, constantly subjected to the hard work and hard knocks of the daily routine. Then judge which is the victor in this test of service.

You'll find when the other broom is worn ragged and is ready for the scrap heap, the Lay Broom is still handling its job in the same efficient way; sweeping tip evenly worn, its handle still firm and every fibre tightly gripped by the stapled metal case that only Lay Brooms can boast.

Small Item — But a Big Leak

Yes, your sweeping expense is a small item among all the bigger operations in your plant. But, there's a leak here, and just like all leaks, it eats into your net profits. Stop it—equip your sweepers with Lay Brooms.

They are built to do the sweeping job the way you want it done; the way you expect good brooms to do it.

The Joseph Lay Company

120 College Street
Ridgeville, Indiana

Originators of the Metal Case Broom

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(Continued from page 48)

mills in the negotiation of property sales, the negotiation of credit, the adjustment of fire losses, and the safeguarding against financial loss through clerical mistakes or through fraud."

The use of the system, forms and entries, is fully explained in the Manual, enabling each concern to adapt it easily and quickly to its needs.

The Manual is divided into fifteen main sections, briefly described as follows:

1. *Statements,* comprising Condensed Comparative Balance Sheet, monthly; Condensed Operating Statement; Detailed Operating Statement, Logging and Mfg. Costs; Ditto, Cost of Sales, and By Products; Ditto, Distribution of Overhead Items.

2. *Forms,* consisting of Cash Receipts; Settlement Journal (Accts. Receivable, etc.); Bank Check Register; Journal; Voucher Register; Sales Record; Sales Journal; Sales Analysis; Lumber Record; Voucher Distribution Record; Journal Voucher Form; Insurance Register; Prepaid Supplies and Expenses Register; Ledger; Pay Roll; Camp Time Sheet; Mill Time Sheet; These Forms are all shown in detail.

3. Chart of Accounts: List of the 158 major accounts, under main headings of Assets; Liabilities; Capital; Revenues; Purchase; Operating Costs & Expenses; Logging; Manufacturing; Selling Expenses; Administrative Expenses.

4 to 12, inclusive: Detailed Analyses of Items Summarized in (3), explanation of each account, purpose, and also credits and debits to be made.

4. Assets: Petty Cash Fund; Cash Undeposited; Bank ; Accts. Rec.; Notes and Acceptances Rec.; Ditto endorsed; Inventories; Inv. Stock of Supplies; Camp Wood; Investments U. S. Lib. Bonds; Inv. Stocks and Bonds; Real Est. Non-Oper.; Sinking Fund; Timber & Timber Land; Real Est. Mill Site; Real Est. Town Site & Other; Mfg. Plant, Bldgs; Mfg. Plant Equipment; Logging Equipment; Railroad; Furn. & Fixtures; Stock in Sub. Cos.; Unexpired Insurance Premiums; Prepaid Supplies and Expenses; Temp Spurs;

5. Liabilities: Pay Roll; Time Orders Payable; Commissions Payable; Vouchers Payable; Accounts Payable; Notes and Acceptances Payable; Accrued Interest; Collateral Notes Payable; Notes and Acceptances Endorsed; Unredeemed Coupons; Accrued Taxes; Reserve for Bad and Doubtful Accounts and Notes; Reserve for Anticipated Accounts; Reserve for Freight; Reserve for Depreciation; Reserve for Anticipated Repairs; Reserve for Shut Down Overhead; Mortgage Bonds;

6. Capital: Capital Stock; Surplus; Surplus, Timber and Timber Lands Appreciation; Profit and Loss;

7. Revenues: Logs Sawn; Saw Mill; Logs Sawn; Shingle Mill; Logs, to Others; Logs Lost and Used; Sales, Lumber; Allowances; Underweights (with Illustrative Entries); Lath; Wood and Sawdust; Box Shooks; Cut Up Factory; Shingles; Lumber Sales, Direct Shipments; Store Merchandise; Camp Commissary; Hotel; Mill Mes-

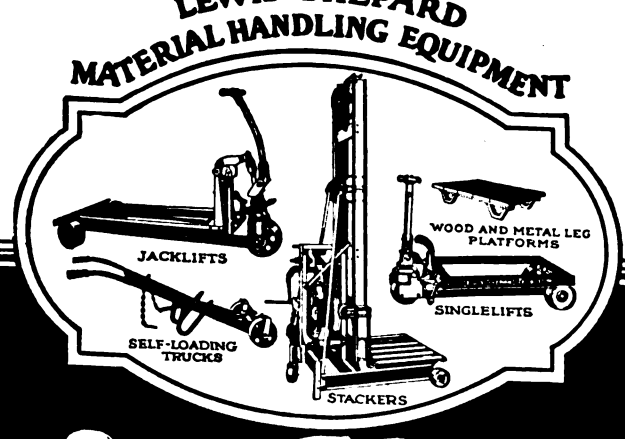
Over 600% Profit in one year

This experience of 24 average customers strengthens our conviction that Lewis-Shepard Jacklifts, Stackers and Platforms cut down the cost of labor and increase operating efficiency more than any other labor-saving product on the market.

The service of our experienced Sales Engineers is yours for the asking. Just write,—and we will gladly have one call. Without obligation on your part he will show you how to improve your material handling methods and *save men and money* with Lewis-Shepard Equipment.

Write us today at our factory address

Lewis-Shepard Co.
582 E. First Street
Boston, Mass.



"No advance in Prices"
The L-S Slogan

Branches in 22 Principal Cities

Lewis-Shepard
BOSTON

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House; Camp Mess House; Camp Bunk Houses; Barn; Power, Light and Water; Rentals; Floating Equipment; Outside Service; Stumpage, Profit and Loss; Sundry Income; Discount Taken; Interest Received;

8. Purchases: Logs Sawn; Logs Purchased; Lath; Lumber to Box Factory; Lumber to Cut-up Factory; Shingle Mill, Logs; Shingles Purchased; Lumber Purchased, Mill; Lumber Purchased, Direct Shipments;

9. Controls: Labor; Supplies; Expense; Repairs; Power, Light and Water; Blacksmith and Machine Shop, Mill; Ditto, Camp; Selling, Administrative;

Operating Accounts, not recorded in General Ledger, but kept on Form 6; Distribution of Operating Accounts;

10. Logging Costs: Contract Logging; Rigging Ahead; Falling and Bucking; Yarding and Loading; Wire Roper; Depreciation, logging; Railroad; Spur Tracks; Water Haul; Other Haul; Booming and Rafting; Boom Stick Towing; Depreciation, Transportation; Salaries and Wages; Sundry Expenses; Anticipated Repairs; Shut Down Overhead; Logs Lost; Stumpage;

11. Manufacturing Costs: Pond or Log Yard; Saw Mill; Sorting Table; Dry Kiln; Timber Dock; Transportation; Piling; Rough Dry Shed; Dry Sorting; Finished Shed; General Planing Mill; Sizer; Depreciation; Salaries and Wages Sundry Expenses; Anticipated Repairs; Shut Down Overhead;

12. Miscellaneous Costs; Lath; Wood; Box Factory; Cut Up Factory; Shingle Mill; Shipping;

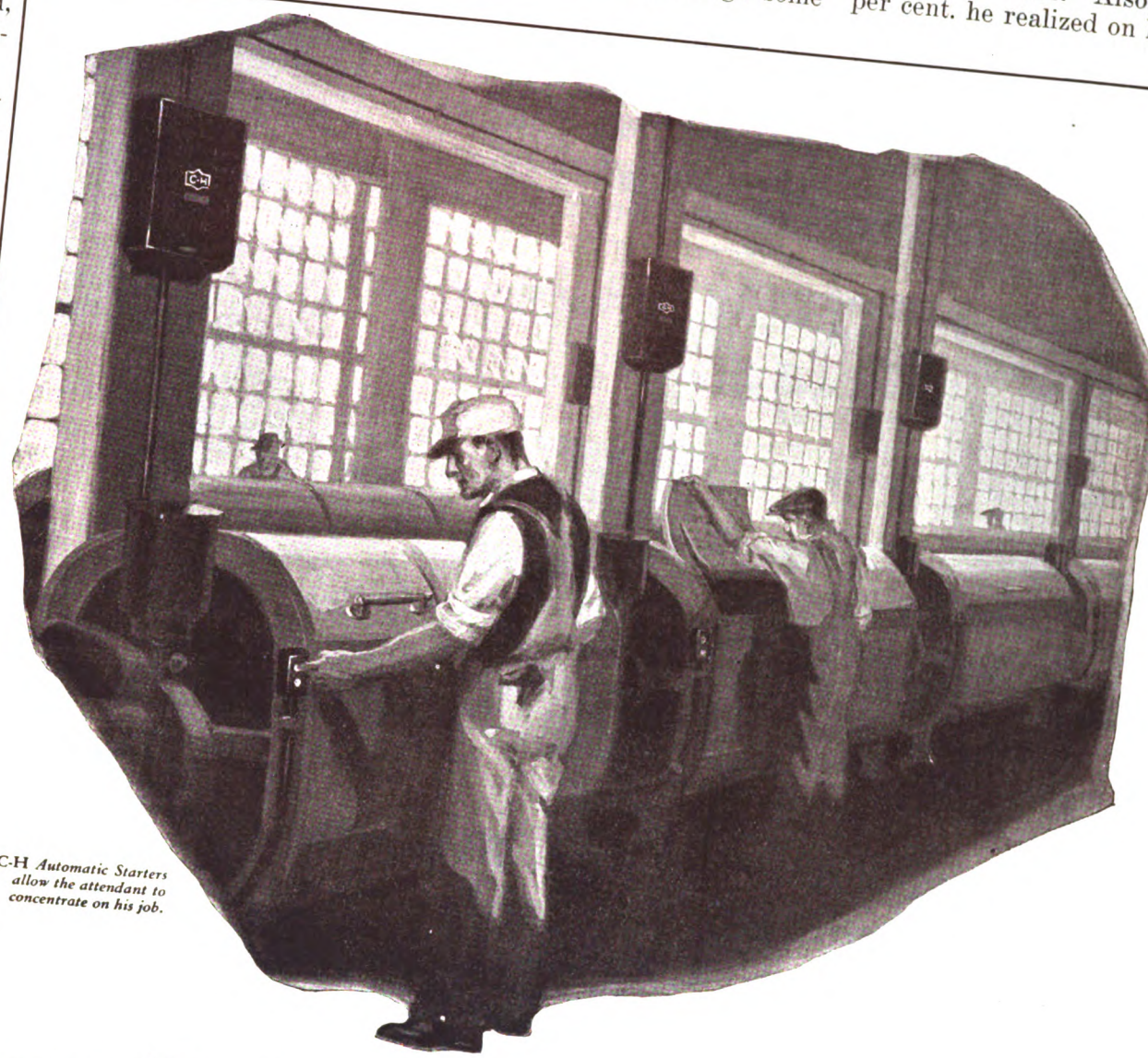
13. Selling and Administrative Costs: Selling; Branch Expenses; Salaries; Supplies; Rent, etc.; Professional Expenses; Interest, Taxes, Discount, etc.

14. Explanation of Forms: Form 1, Cash Receipts and Settlement Journal; Form 2, Check Register; Form 3, Journal and oucher Register; Form 4, Sales Journal; Form 5, Sales Analysis; Form 6, Distribution; Form 7, Journal Voucher; Form 8, Insurance Register; Form 9, Prepaid Supplies and Expenses Register; Forms 10A, 10B, 10C, Accounts Receivable; Form 15, Pay Roll; Forms 16A and 16B, Time Sheets;

15. Explanation of Statements: Monthly Report; Detailed Operating Statements, three; Condensed Operating Statement; Methods of Determining Production and Sales;

Study of these headings and the Manual reveals the completeness of the record for all logs used, cost, disposition and revenues; also the detailed record of each one of the 62 operations involved in converting the tree into wood products. It is surprising to find that 75 different products are regularly manufactured by the average mill, though some are equipped for some of these products only.

When the modern millman turns to his statement at the end of each month, he knows exactly what his mill has accomplished; what kind of lumber was milled; what was sold; what it cost him; and what the net returns were. Also, what per cent. he realized on his in-



C-H *Automatic Starters allow the attendant to concentrate on his job.*

Increased Production Through Eliminating Delays

Cutler-Hammer engineers have for over a quarter-of-a-century specialized in designing and applying control apparatus to improve motor driven machinery production.

In many cases the substitution of automatic controllers increases production by relieving workmen; by pre-selecting proper speeds; by reducing annoying and costly delays due to fuse blowouts and motor burnouts.

The safety type Starter shown above is entirely enclosed, mounted out of the way, with start and stop station located within easy reach of the workman. In place of fuses, this Starter has Mercury Overloads which permit a better starting current for the motors, and protect the motor windings against overheating and burning out. They reset automatically after an overload trips them.

Cutler-Hammer engineers may be able to help you increase production with your present plant capacity by improving the motor drives and control.

THE CUTLER-HAMMER MFG. CO.
Motor Control Department
Works: MILWAUKEE *and* NEW YORK
Offices and Agents in Principal Cities
Northern Electric Co., Ltd., Can.

C-H CUTLER-HAMMER

AUTOMATIC STARTERS

BULLETIN 9604 WITH MERCURY OVERLOAD RELAYS

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vestment (if any) and whether it will pay to run the mill next month on full, half time, or no time at all. *He knows where he stands;* and it is said there is no feeling in the world quite so satisfying as knowing just where one's feet have led him, and toward what goal he is heading. For if it is the wrong goal, there's always another road leading away from it.

Even more important, his records show the "dead line" below which no sane man will operate for any length of time. This line varies, of course, with the location and costs of doing business, but it is fundamentally important to know where one's own limit lies.

Detection and elimination of leakages, with the inevitable result of lower prices, is another practical advantage of this system. It is, of course, the prime object and justification of cost accounting.

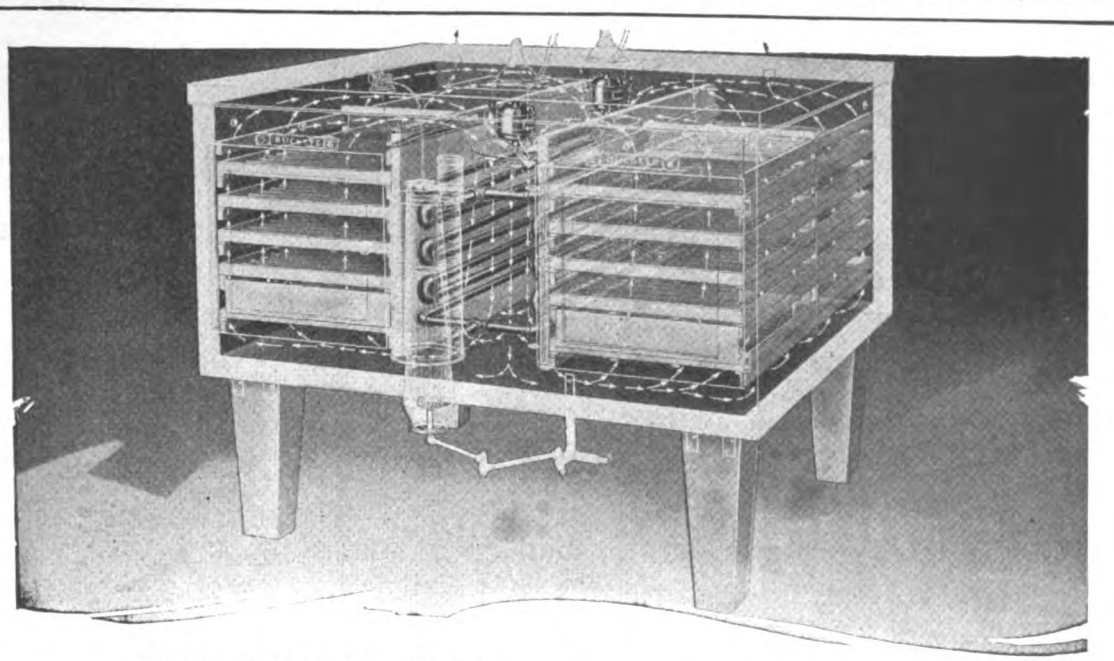
For the sixty-odd mills which make regular monthly reports to the offices of the West Coast Lumbermen's Association, there is the further opportunity of comparing their individual operations with the other reporting mills. A monthly analysis of Douglas Fir Costs and Sales Returns is issued to each of these reporting mills, showing a Condensed Operating Statment summarizing the operations, actual operating gain or loss for the group, and itemizing the operations by feet of lumber cut, amounts received, and final percentage return on invested capital for the entire group, both for the current month and for the preceding calendar months of the year. Thus the millman can compare his operations with those of the group, and with the average of all reporting.

There is also a report summarizing the financial operations of each mill; by an ingenious system of numbering each mill, determined by the relative cost-standing, each millman can obtain financial statement of operations for all the others, in code, compare his own standing by knowing his own report, but is unable to identify the other reports. Thus no unfair advantage can be taken of the reports, yet each millman can find his own report, analyze and compare his own operations with the others in the group. No information is ever given out except through these disguised reports.

The system is doing so much to stabilize the lumbering industry in the Pacific Northwest that it may rightly be considered one of the most far-reaching improvements devised by any industry in the country. Every person in the United States is vitally interested in these methods of bringing lower lumber prices, for each one daily eats, sleeps, works and moves over and in contact with wood products. The high cost of being surrounded and supplied with the product of the forest primeval is being slowly but surely reduced.

The total number of employees on the payroll in 1428 representative U. S. factories at 2,041,000 on June 30th, compared with 2,048,000 on May 31st and 1,722,000 on June 30th, 1922. The total amount of involuntary unemployment in Pennsylvania on July 1 amounted to 8,957 as against 9,465 on June 1 and 124,665 on July 1, 1922.

SKF



10,000 Lives at Stake
Reliance Placed in Ball-Bearing Fans

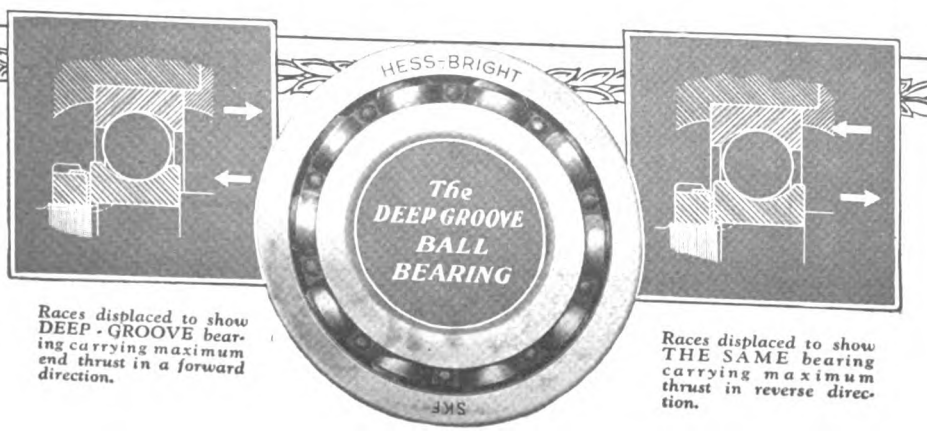
MAMMOTH incubators of this type are built with a capacity of over 10,000 eggs. The hatching of the maximum number of large, healthy, strong chicks from these eggs is dependent upon maintaining an equal distribution of heat throughout the egg chamber and upon continuous uniform ventilation. Failure to maintain the proper temperature and to remove poisonous gases as formed not only reduces the quality but also the quantity of the hatch.

Reliance is placed in electric fans equipped with deep-groove ball bearings made by the Hess-Bright Manufacturing Company to maintain an equal distribution of heat and to remove the poisonous gases. These fans are kept in continuous 24-hour a day operation for a period of five months and are giving complete satisfaction to thousands of users.

Whether your bearing problems lie in the field of industry, transportation or science, ball bearings will give that reliability of performance and precision of operation which you seek.

THE HESS-BRIGHT MANUFACTURING COMPANY
Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

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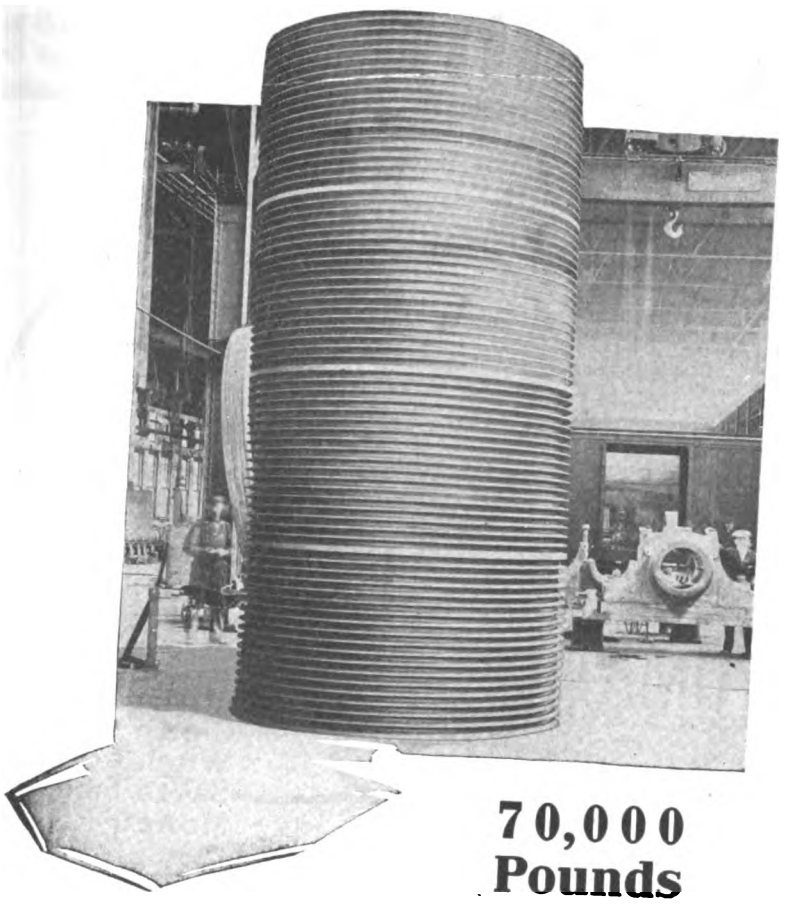
BALL BEARINGS
The Highest Expression of the Bearing Principle

Races displaced to show DEEP-GROOVE bearing carrying maximum end thrust in a forward direction.

Races displaced to show THE SAME bearing carrying maximum thrust in reverse direction.

When writing advertisers please mention Industry Illustrated

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70,000 Pounds

There is no power transmission problem too big for Dodge

THIS immense sheave built up in six sections with a face measurement of 107 inches and a total weight of 70,000 pounds is only a small part of the Dodge built equipment in one of the largest glass factories in this country.

Similar installations of gigantic power harness have been furnished by Dodge for practically every industry. Rolling mills, paper mills, cement plants, coal and metal mines have relied on Dodge for power transmission equipment for over forty years.

The supplying of power transmitting equipment and unusual size and design is but a part of Dodge service to industry. The Dodge line includes everything for the mechanical distribution of power—carloads of stock pulleys, hangers, pillow blocks, etc., are available for shipment from our great central warehouses to our fourteen branches who in turn supply hundreds of local Dodge dealers.

Complete line shaft equipments assembled and tested before leaving our factory are designed and built under the supervision of engineers qualified by long experience in supplying the specific needs of the various industries served by Dodge.

You cannot afford to specify inferior transmission equipment—its efficiency has too great an influence on your profits. Make Dodge the standard in your plant—your judgment will be backed by the thousands of discriminating buyers in every industry who have profited by the continuous service, power savings and low upkeep characteristic of all Dodge installations.

Write for catalog—submit your problems for practical recommendations.

DODGE

Power Transmission Machinery

DODGE MANUFACTURING CORPORATION

General Offices: Mishawaka, Indiana. Works: Mishawaka, Indiana, and Oneida, N. Y

Dodge Manufacturing Company of Canada, Ltd., Toronto and Montreal

New York, Boston, Philadelphia, Pittsburgh, Atlanta, Minneapolis, Houston, Seattle, St. Louis, Chicago, San Francisco, Cincinnati

Personnel Work That Pays Dividends

(*Continued from page 19*)

the work of the medical director. Upgrading of morale and reduction of absenteeism have resulted.

Health and safety education is carried on consistently through demonstration and lecture courses independent of a well established safety committee. Lessons in First Aid, bulletins, distribution of literature, also form a part of this feature.

3. *Advisory Service:*—Considerable stress is laid on the ability of a specialized department such as this, to render aid and advice in legal and personal difficulties. The results and success of this activity may be inferred by increased demand for it.

4. *Plant Organs:*—With geographical and technical differences, two independent plant publications are maintained. These both take the form of small mimeographed sheets published frequently enough to hold interest and carrying real local news. The usual departments run in non-advertising house organs are found.

5. *Employee Activities:*—Mutual aid, athletics, social events are carried on with staff guidance from the Personnel Department. Inter-plant contests have been initiated and a keen interest manifested.

6. *Joint Relations:*—An employees' advisory committee has developed beyond the point of complaints and grievances to a real factor in the solution of problems common to both management and worker.

Through the recognition of sound personnel relationships, technical committees are operating harmoniously and effectively for the coöperation of departments. Considerable educational work is carried on through these committees.

With the aid of the Federal Board of Vocational Guidance courses of foreman instructor-training were recently carried through successfully.

(*Continued on page 55*)

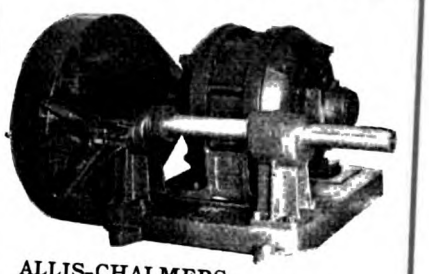
For that

Back Geared Motor

specify a

WATSON-FLAGG

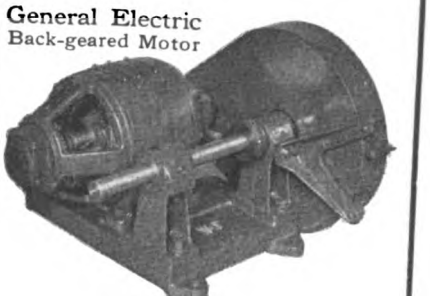
Reduction Gear Drive



ALLIS-CHALMERS
Back-geared Motor

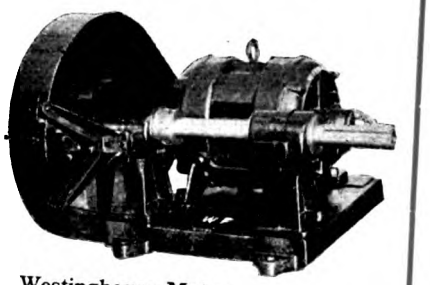
Furnished as Standard Equipment by the better Motor Manufacturers.

General Electric
Back-geared Motor



Watson-Flagg Reduction Gear Drives will fit ANY Standard Motor of Any Make.

Large stocks insure prompt shipment on receipt of motor at our works for mounting.



Westinghouse Motor
Equipped with W-F
Reduction Gear Drive

Ask Your Motor Manufacturer or

WATSON-FLAGG

ENGINEERING COMPANY
PATERSON, N.J.

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Steam Pressures are going up. So is the price of coal

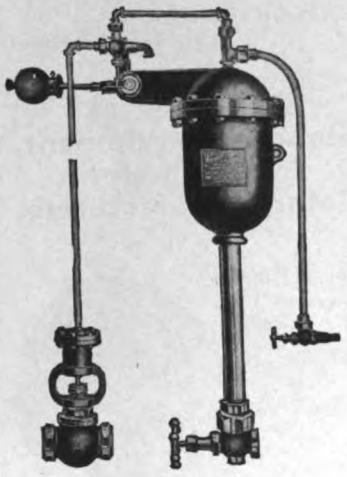
The best equipped plants have the best efficiencies

Two power plants, one in Boston —one in the West are going to 1200° and 1500° steam pressures. Fine, but the majority of plants will have to wait and see what happens.

Probably nothing spectacular will happen for these power plants expect higher operating costs as in the past with a probable increase in the price of coal.

But a larger number of power plants than ever before are paying strict attention to their water levels. Engineers are realizing more and more that it is impossible to obtain maximum economy and efficiency through hand regulation of boiler feeding. They are right. It does take automatic mechanical regulation for that.

VIGILANT Feed Water Regulator



And when it comes to a Feed Water Regulator, there is nothing like having an old reliable Vigilant on the job. They hold the water at a fixed point under all operating conditions and at all boiler loads. Their use insures drier steam, increased boiler capacity, greater fuel economy.

Get our engineers' recommendation. No Obligation.

Write for the catalog today.

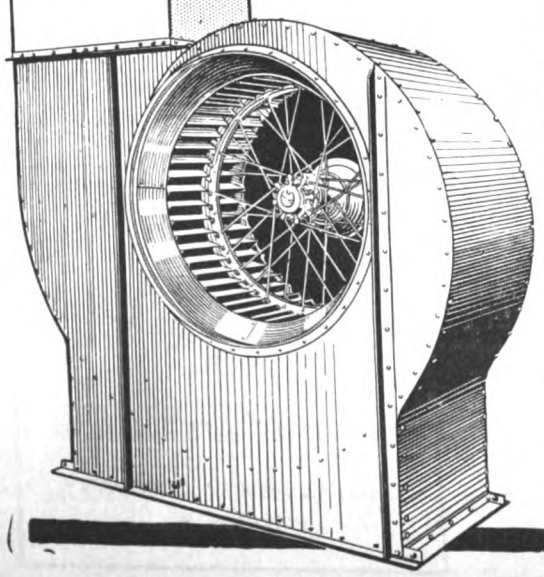
The Chaplin Fulton Mfg. Co.,
28-36 Penn Avenue
Pittsburgh, Penna.

EFFICIENT VENTILATION

Can be obtained only through the use of equipment designed to meet the specific requirements for which it is intended.

Bayley PLEXIFORM FANS

are made in a variety of capacities from 300 to 300,000 cubic feet per minute. They are designed especially with a view of handling a maximum volume of air from a minimum of space and power requirement. Their efficiency as proved by installations in thousands of the largest industrial, public school, theatre and office buildings, makes them prime favorites with architects, engineers and owners.



Write for Catalog

BAYLEY MFG. CO.
DEPT. (P)
MILWAUKEE, WIS.

Drinking Water



Automatically Cooled Water Can Be Mighty Profitable to *Your Plant*

Icing drinking water coolers is a costly nuisance. It's sloppy, unsanitary, inadequate —objectionable to the management and employees alike.

One mill recently reported saving over *$25.00 each year* SINCE they installed their Automatic Refrigerating Plant.

Besides this marked saving of cooling water without the trouble of handling ice, they have noticed a great reduction of time lost from productive work. The handy bubblers are distributed about the plant and supply an abundant amount of drinking water at always an even temperature. Cases of cramps and other sickness due to improperly cooled water have been entirely eliminated. Electrically driven, Automatic Plants require no skilled operators and little or no attention. They operate themselves.

No progressive manufacturer can ignore the advantages and savings of Automatically cooled drinking water systems. The subject is treated in detail in literature which we will gladly mail upon request. Write for a copy of our latest booklet today.

A few of many well-known plants equipped with Automatic Refrigerating Systems:

Graton & Knight Mfg. Co., Worcester, Mass.
Bridgeport Brass Co., Bridgeport, Conn.
Kiefer-Stewart Co., Indianapolis, Ind.
National Acme Co., Windsor, Vt.
Royal Worcester Corset Co., Worcester, Mass.
Fuller Brush Co., Hartford, Conn.
Hendee Mfg. Co., Springfield, Mass.
P. & F. Corbin Div. American Hardware Corp., New Britain, Conn.
H. Fendrich, Evansville, Ind.
Riverside & Dam River Cotton Mills, Danville, Va.
Carnegie Steel Co., MacDonald Bar Mills, Youngstown, Ohio

The Automatic Refrigerating Co.

Home Office and Works: Hartford, Conn.

Automatic Service is Nation Wide.

Offices in Many Cities

TRADE MARK
Reg. U.S. Pat. Off.

"Like the Old Cold Spring"

How you can bring it into your plant →

TEAR OFF AND MAIL TODAY

To The Automatic Refrigerator Co., Hartford, Conn.
Please send me your latest catalog without obligation.
Name .....
Firm's Name .....
No. of Employees .....
Position .....
Street .....
City .....
State .....

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(Continued from page 53)

7. *Records and Analysis:*—The necessity of keeping accurate and informative records was recognized at the outset, as effective personnel work cannot be administered on "Hunch," but must be based on an intelligent interpretation of real FACTS.

As an aid to systematic collection of these facts the "Table of Routine and Reports" was devised. This acts as a tickler and simplifies the task of collecting and routing all Personnel Department forms, as it tabulates the functions, duties of individuals, and times for the performance of these duties.

Turning to an analysis of some of these records, let us refer to *Fig. 7*, which is a composite chart of turnover and number on pay roll for the years 1920, 1921, and 1922 in one of the plants of the central group.

The nature of the products calls for a class of worker which is largely influenced by the demands of seasonal industries, such as canning and agriculture. In the first half of 1920 the efforts of the Personnel Department had, of course, not been felt, turnover then being at its highest. In 1921 when deflation had set in, wage reductions were engineered by the Personnel Department and turnover held at a minimum, with the working force slightly reduced. During 1922, in the face of wage increases in several industries and with business returning to normal and a special demand in the building trades, turnover, although higher than in the previous year, was held down, the force being steadily augmented the while.

An interesting illustration of the value of figures as shown on this chart may be cited here. At the annual general sales convention in December, 1921 the fluctuations in the working force from week to week were displayed graphically with the result that a sales policy was immediately formulated which leveled out the peaks and automatically improved product, production and profit as well as stabilizing employment. The curve for 1922 is distorted upwards by the opening of a new department in July.

Analysis of the payroll on January 1st, 1923, shows that 13 per cent. had over five years' service, 35 per cent. over two years and 58 per cent. over one year.

The percentage of terminees in 1922 with one year's service was half that of 1921. This reflects the improved working conditions effected by the Personnel Department.

Similarly, information is obtained as to ages of employees and terminees. Twenty-four per cent. on January 1st, 1923, were between the ages of twenty and twenty-five, this being the highest percentage by groupings of five years. The highest number of terminees was also in this group (32 per cent.); which was also the highest group in 1921 (22 per cent.).

Annual comparison of employees and terminees is made by nationality and marital status in order to see that a proper balance is maintained. No disproportion has developed during the observed periods.

Accurate absentee records have been developed showing

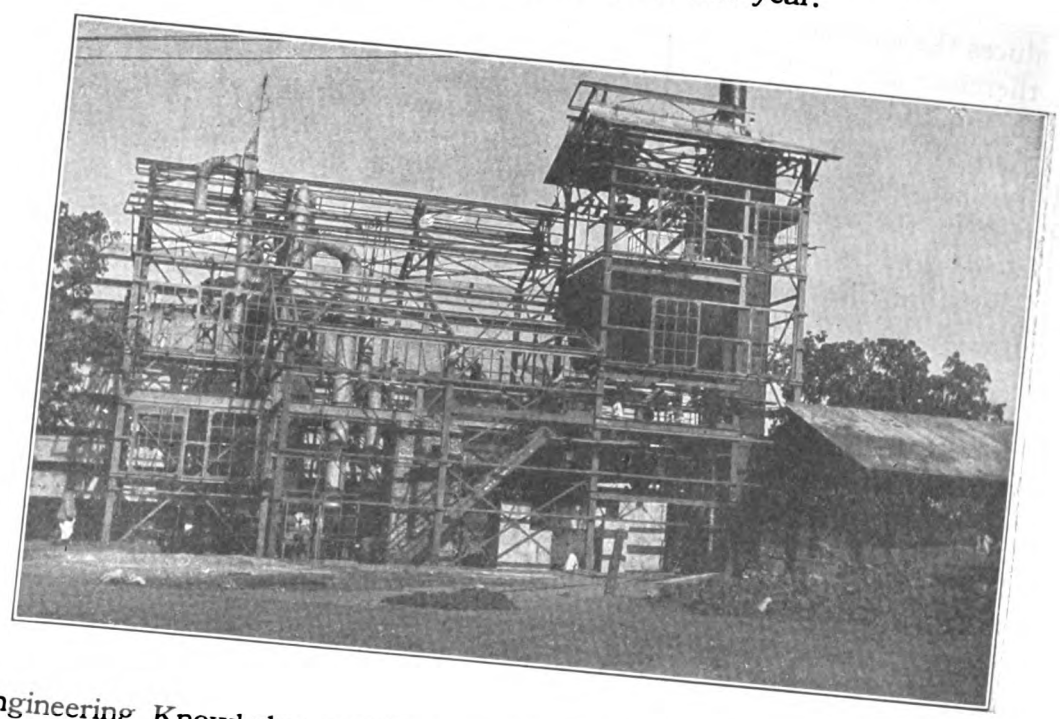


A Letter from India—

——— tells the marked success of the Holbeck Pulverized Coal System in the plant of the Agricultural Implement Company, Jamshedpur, INDIA.

This plant was the subject of a paper delivered by Mr. T. M. Dawson, Vice President, at the annual general meeting of the Institution of Engineers (INDIA) in January of this year.

The Plant



The Engineering Knowledge and Manufacturing Skill which can produce successful pulverized coal equipment for a company in India, thousands of miles away, is at your service -- in the United States.

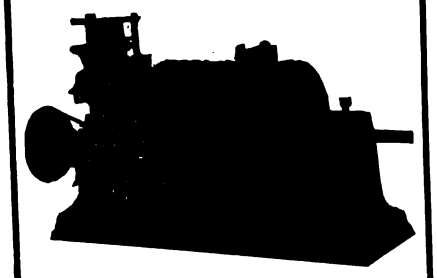
Write for Bulletin No. 600

The Bonnot Company

CANTON, OHIO

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Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway
New York

causes. These disclose an improvement wherever control is exercised. Lost time from

	1921	1922
(a) accident	.61%	.19%
(b) sickness	1.6 %	1.4 %
(c) personal reasons	.9 %	.6 %

Marked improvements have been made in the sanitary, hygienic and safety conditions of the plants, but it has been difficult to keep ahead of the general growth.

The justification of expanding the scope of this department was found by the successful experience with the first unit. The unique features of this plan are that all of the functions are directed from and responsible to, the central head office.

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

FROM SCRAP AND PIG TO STEEL CASTINGS

The Detroit Steel Casting Co.

THE ELIMINATION OF RE-HANDLING

Lewis-Shepard Co.
Barrett-Cravens Co.
Yale & Towne Mfg. Co.
Cowan Truck Co.
Lakewood Engineering Co.
The Baker R & L Co.
Automatic Transportation Co.
The Elwell-Parker Electric Co.
Stuebing Truck Co.
Clark Tructractor Co.
Youngstown Pressed Steel Co.

PERSONNEL WORK THAT PAYS DIVIDENDS

The Paraffine Companies, Inc.

SOLVING THE "IMPOSSIBLE"

Link-Belt Co.
Jeffrey Mfg. Co.
Palmer-Bee Co.
The Dow Co.

CUTTING THE EXCESS COST OF COAL

R. H. Beaumont Co.
Link-Belt Co.
Jeffrey Mfg. Co.
Godfrey Conveyor Co.
Shepard Electric Crane & Hoist Co.
Brown Hoisting Machinery Co.
Universal Crane Co.
The Elwell-Parker Electric Co.
The Browning Co.
The Barber-Foster Engineering Co.

HERE IT IS

New Catalog Showing How to Reduce Blue Printing Costs 50%



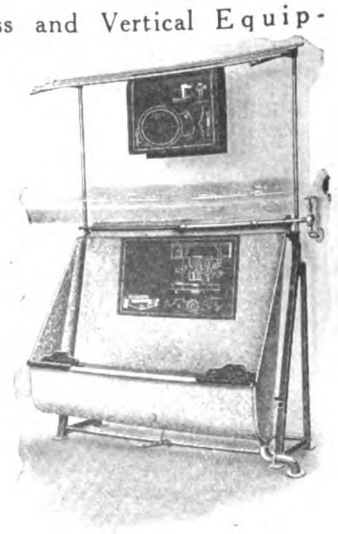
Illustrates and describes in detail the Pease method of making blue prints—shows how maintenance expense can be reduced to a minimum—proves that blue printing costs, on the average, can be cut 50%.

The Pease-Vertical and the Pease Peerless Machines have been decided on as the best of their type by the engineer and commercial blue printer—the men who know. The fact that there are more Pease machines in use than all others combined proves this.

The saving in actual expense is only part of the story told in Catalog M-23—blue prints can be made, with the Pease method, almost instantaneously, removing many costly delays in planning and production.

In the case of both the Peerless and Vertical Equipments, the printer may be purchased separately if desired. However, the complete equipment, in each case, provides, far the, by most economical combination for turning out blue prints.

Pease Blue Printing Machines are so simply constructed that any intelligent boy or girl can run one and divert his or her spare time to other duties. This is an exceedingly important point today, when ordinary labor is scarce and high priced.



This Washer together with the Pease-Vertical and Pease Sheet Dryer form a very economical method of turning out a steady supply of perfect prints.

Write for Catalog M-19

THE C. F. PEASE COMPANY

819 N. Franklin St., Chicago, Ill.

PEASE CHICAGO

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Cutting the Excess Cost of Coal

(Continued from page 26)

eventually ignite the pile. By no means should these pipes be left open at the bottom. The supposed ventilation thus secured is in reality an excellent chimney draft and aids, rather than prevents, combustion.

Bunkers and bins within the boiler house should also be divided up into compartments, so that any fire starting in one compartment may be segregated.

Exposed coal piles are not good, for several reasons. They are subject to alternate wetting and drying from the summer rains and winter snows. They are also subject to freezing and thawing. Thus the coal lumps are gradually broken apart, exposing fresh surfaces for oxidation. The result is two-fold. First, there is a slow depreciation in the heat value of the coal itself, especially with bituminous coal. Second, if the coal is subject to spontaneous combustion, these conditions tend to make the process a little more rapid. The oxidation and deterioration in exposed coal piles is more rapid in summer than in winter weather.

Coal is delivered to the boiler house, either direct from the railroad cars, barges or trucks, or from the storage pile itself. In hand-fired plants a part of the firing floor must be reserved as an inside coal reserve. Many such plants have replaced the old-time wheelbarrow by electrical industrial trucks or other more efficient means of handling. Where the hauling distance is greater than 100 feet and the quantity of coal burned exceeds 20 tons a day, the installation of an automatic conveyor system is often justified. No fixed rule can be laid down, however, and the economy of an automatic system of some kind will depend upon the particular conditions at each individual plant.

Overhead bunkers are always desirable in stoker-fired plants of any size, because they eliminate additional handling of the coal within the boiler house, permitting the coal to feed to the stoker hoppers through downspouts by gravity. The bottoms of these bunkers slope at an angle of from 35 to 45 degrees, the angle being just a trifle greater than the angle of repose for coal. Convenience in framing makes the 45 degree angle more desirable.



A weighing scale which weighs the coal in transit over the belt conveyor.



Why the light shines bright tonight along Main Street

THE light shines bright tonight on your town's Main Street largely because mechanical stokers in the power house are on the job.

The stokers were probably placed there during recent years—were placed there because the use of more electricity had called for more steam to turn generators, more heat to make steam—more heat than could be produced in the old fashioned boiler furnaces fired by hand.

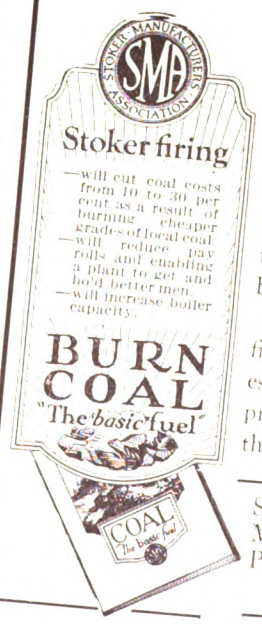
And the stokers were placed there by men whose business is selling power—and therefore making it at the lowest possible cost. They were placed there because these men knew that hand fired furnaces wasted their chief raw material—coal. The cost of these stokers had to be justified by operating economies—coal and labor saved!

Can any maufacturer who uses steam afford to overlook the example of men who have made power cost a life-time study? Is not coal just as definitely a part of every product as the materials used directly in its manufacture?

There is a type of mechanical stoker for plants of every size—a stoker that will pay large returns on the moderate investment it involves. The manufacturer of that stoker has more to sell than an automatic machine for firing furnaces, he has engineering counsel to offer, the product of specialization in the great cost-cutting field of scientific combustion.

Why coal should be your fuel and why a stoker fired furnace is the way to fire it, is told in an interesting book "Coal—the Basic Fuel." The facts presented in the pages of this book may save you thousands of dollars annually.

STOKER MANUFACTURERS ASS'N
MR. G. A. SACCHI, LESTER BRANCH,
PHILADELPHIA, SECRETARY STOKER
MANUFACTURERS ASS'N



Read why you should burn coal and how you should burn it.

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Mechanical means for elevating the coal to these overhead bins, after it has been delivered to the boiler house, are essential. After the coal has passed through the crusher it may be delivered to a bucket elevator, which is merely a series of buckets fixed to an endless chain belt, which passes over power-driven sprockets. The buckets dip into a boot beneath the crusher and pick up the crushed coal after it passes through the rolls, carrying it vertically upward and discharging it into a horizontal conveyor for distribution to the proper bin in the overhead bunkers.

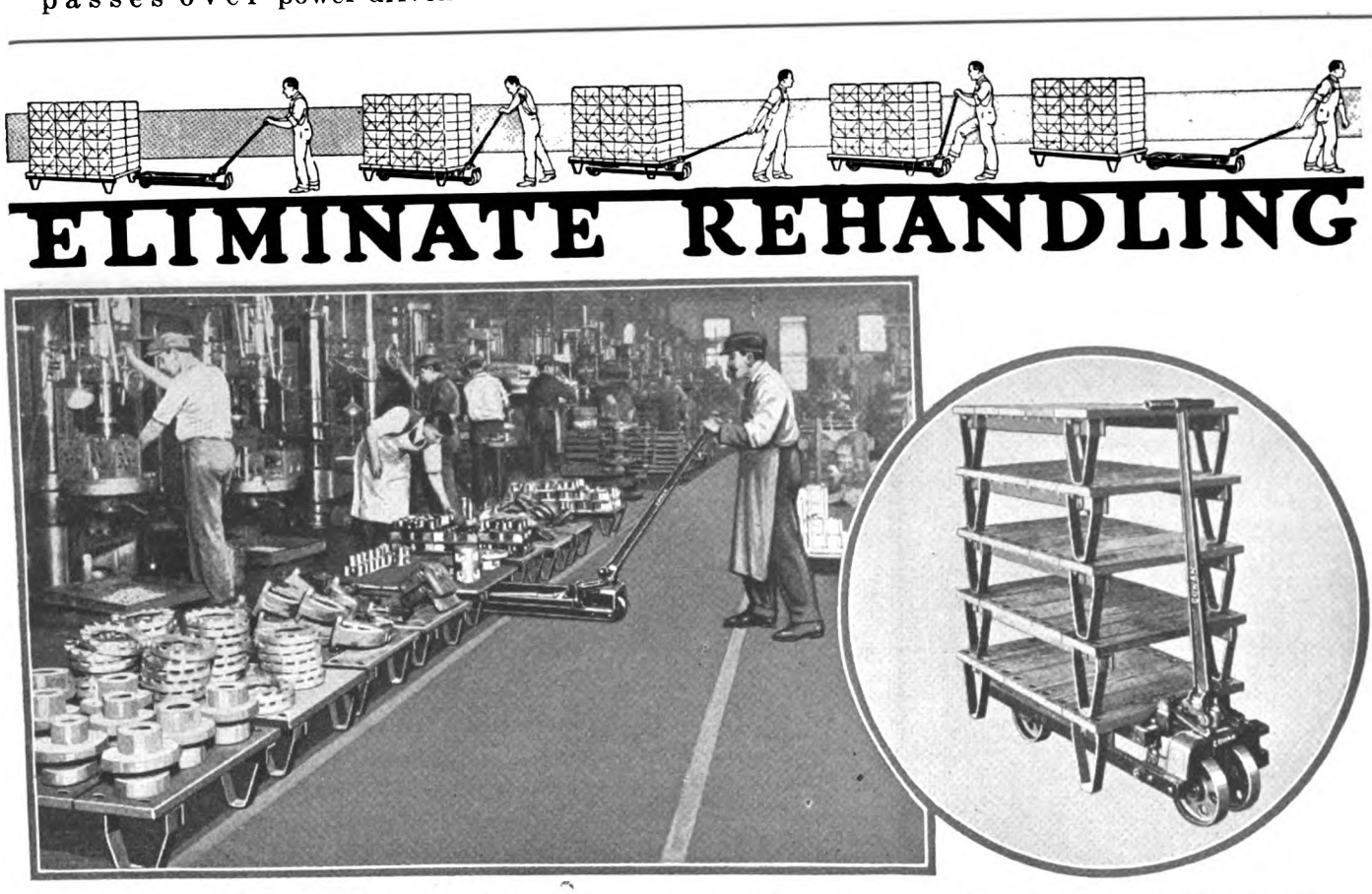
There are many other forms of elevators for accomplishing this purpose and the selection of any particular one depends upon the layout and conditions at the plant. In many cases the skip hoist has been used for this purpose very successfully. In other cases an apron conveyor, and sometimes a scraper conveyor, have been found suitable. Frequently, also it has been found desirable to combine both the elevating and distributing processes in one mechanical operation by the use of a bucket type of conveyor which elevates the coal vertically and carries it horizontally over the bunkers, discharging it by means of a trip located at the proper point.

In such a system as just described, the lower or return run of buckets is usually carried under the boiler room floor and serves as an ash conveyor as well. Thus, one mechanical conveyor does the work of three conveyors, namely, elevating coal, distributing coal, and discharging ashes. With this type of conveyor, however, additional mechanical means is required to handle the coal between the crusher and the conveyor proper. This is usually accomplished by a reciprocating feeder, which is adjustable to feed varying amounts of coal. When the distance from the track hopper to the bucket conveyor makes the use of a feeder impractical, a continuous belt feeder is used.

Belt conveyors for distribution of the coal to various bins in the bunkers consist essentially of a thick belt of suitable width, driven by pulleys and carried upon idlers, so arranged and mounted that the belt assumes the shape of a trough, in which the coal is carried. Usually the belt is composed of woven cotton duck covered with a special rubber compound on the carrying side and has unusual wearing qualities. In the middle the thickness of the rubber is increased, since the service will be severest at that point. The belt thickness is uniform, however, throughout its width.

Automatic tripping devices are provided at proper points and cause the coal to be discharged where it is wanted.

In some cases economical methods of handling coal are possible without the use of conveyors, even in large central stations. The power plant of a large traction company in Illinois is so designed that railroad cars dump into unusually large hoppers beneath the tracks. Narrow gage industrials cars of 1-ton capacity run under these hoppers and receive coal from the hoppers by opening coal valves located at regular intervals. These indus-



Cowan Hand Lift Truck and skid platforms in the drill press department of a large manufacturing plant. Rehandling of incoming and outgoing materials is entirely eliminated.

Cowan Hand Lift Truck and Skid Platforms



Here, stored skins are quickly and easily moved by the Cowan System without rehandling.



Manual handling of these heavy loads would be slow, costly work. Quick, easy work here.



Through the Cowan System, even a girl can move loads weighing several thousand pounds.

This System has reduced material handling costs for thousands

In shop, warehouse, and factory—in businesses covering a range too wide for simple classification—the Cowan Hand Lift Truck and Skid System has effected remarkable material handling economies.

So broad has been the application of the Cowan System that it is quite probable that you, too, could save many thousands of dollars per year through adapting it to your own needs.

Why not see for yourself how the Cowan System has reduced handling costs in your particular line of business? Just write, briefly describing the goods or materials you handle, and we'll gladly send you information pertinent to your own problem.

COWAN TRUCK CO., 6 WATER ST., HOLYOKE, MASS.

Representatives in New York, Chicago, and other Principal Cities.

Largest Manufacturers of complete Hand and Electric Industrial Truck Systems.

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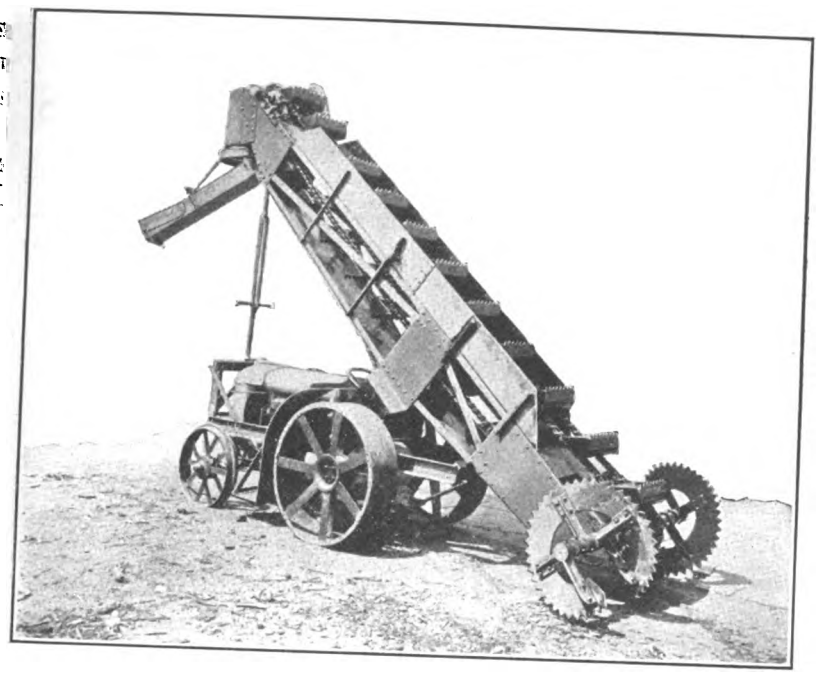
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Why waste

Money-Time-Labor

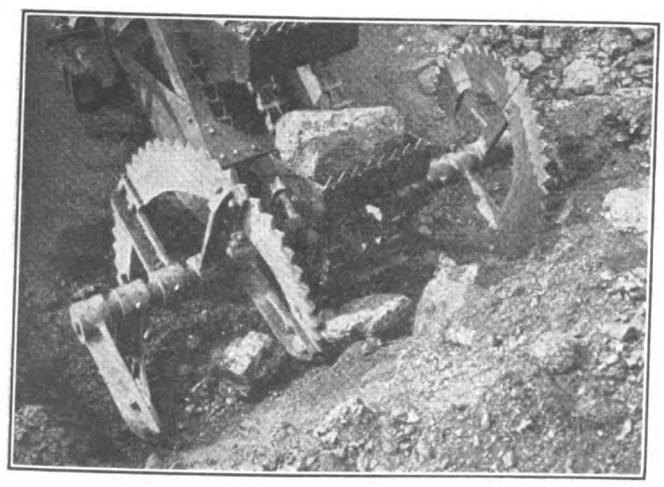
shoveling coal?



When the **NELSON**

Fordson Truck-Loader

will load 30 to 35 tons of coal an hour from stock-pile into trucks.
One-man operation.
No hand shoveling.
Cleans up as it goes.
Swivel spout for side or end loading.
Only eight feet high when lowered.
Use it for coal, ashes, sand, gravel, etc.
Loader readily removed when tractor is desired for other service.
Furnished complete with tractor, or mounted on your own Fordson.



The business end—in soft coal

N. P. NELSON IRON WORKS, Inc.
200 40th Street, Brooklyn, N. Y.

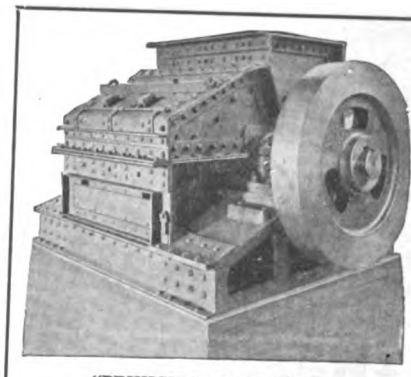
trial cars are of special construction with roller bearing axles and a combined ratchet lift and friction dump. They are pushed on to one of two elevators which lift them to another track above the bunkers, where they are dumped at the desired point. Four men handle the coal and ashes for the ten boilers in this plant.

Another large central station in the middle west has a slightly different coal handling system from any yet described. It consists of a receiving pit beneath the railroad track outside the boiler house. Directly above this track an overhead storage of 1,600 tons capacity is carried on suitable steelwork. Above the storage bins an electric hoist operates to raise the coal from the receiving pit and distribute it to the bins, whence it flows by gravity into the stokers in the boiler house. One man and a helper, working five hours a day, handle an average consumption of 200 tons with this system.

Simplicity and reliability are the two main factors to be considered in the selection of a system for handling coal. It is sometimes possible to design such a system that will handle coal directly from the cars or from the receiving pit, either to the bunker in the boiler-house or to the outside storage pile, and, at the same time handle all the ashes and refuse, with the same mechanical equipment. This very thing has been accomplished with the electric hoist and trolley, running on an overhead track and hoisting coal from the delivery track and carrying it into the building itself, or in the opposite direction to the adjacent storage pile.

As a rule coal is fed from the overhead bunkers to the stoker hoppers directly through downspouts. Some plants have found it desirable, however, to omit the continuous spouts for each individual boiler and to substitute instead one or more weighing hoppers, operating electrically on a track underneath the bunkers. From the hoppers a spout extends out to the stoker hopper. In this way the coal fed to each individual stoker may be recorded. A single weighing hopper is sufficient to serve several stokers and may be quickly shifted from one unit to another. Such

(*Continued on page 61*)



"PENNSYLVANIA" SUPER HAMMER MILL
Weight 20 tons.

Quarry Iron

THE 16" steel wedge, shown below, is *tough* Hammer Mill "fodder," but.....



the Patented Tramp Iron Separator in a "Pennsylvania" Super picked it out automatically without damage to the Mill,—and unknown to the operator.

This device is only one of the many SUPER factors in powerful STEEL-BUILT "Pennsylvania" Hammer Mills, which justify careful investigation.

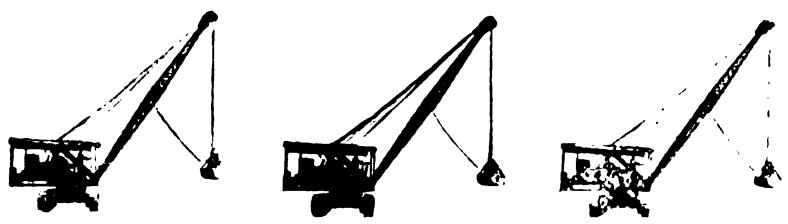
"Pennsylvania" design insures the *lowest cost per ton, for the long pull,* rather than the *lowest price per pound of machinery.*

New Bulletin 1005 outlines SUPER Design and Service. Send for your copy.

PENNSYLVANIA CRUSHER COMPANY
1320-1325 Stephen Girard Bldg.
PHILADELPHIA, PA.

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One out of every three NORTHWESTS is a repeat order



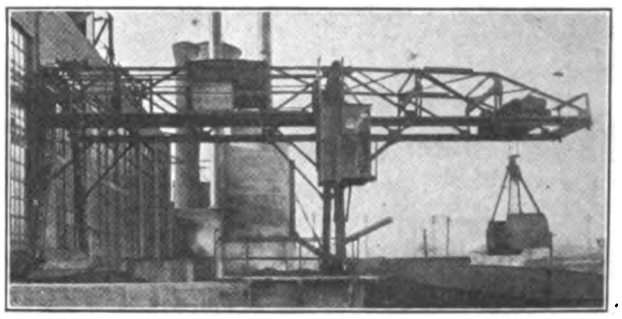
There is no greater testimonial of satisfaction than repeat orders for NORTHWESTS from responsible concerns.

Ease of handling, power and economy of operation builds up a satisfaction that makes them think in terms of NORTHWEST.

Make your first order a NORTHWEST and there is no doubt about what your second machine will be.

NORTHWEST ENGINEERING CO.
1231 STEGER BLDG.
CHICAGO

NORTHWEST
GAS or ELECTRIC
CRANE
DRAGLINE
SHOVEL



Four-Motor Bucket Gantry Crane

BARBER-FOSTER HOISTS & CRANES

THERE is a *Barber-Foster* electric hoist or traveling crane; wall, jib, gantry or special crane to meet every requirement of industry. Let our engineers make a suggestion to meet your requirements.

Standard Features

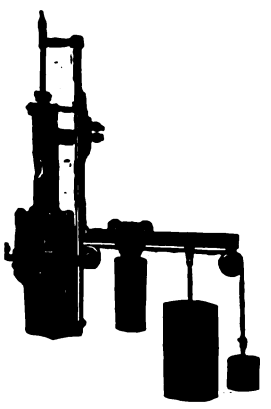
High duty Roller bearing throughout.
Carbonized and hardened gears.
Hardened and ground shafting.
All mechanical moving parts inclosed.
Alemite oiling system.



Cab Operated Monorail

THE BARBER-FOSTER ENGINEERING CO.
EUCLID-WINDSOR BLDG.
CLEVELAND, OHIO
PITTSBURGH DETROIT NEW YORK BOSTON

Better Control of Operating Pressures Cuts Boiler Room Costs—



Mason Damper Regulator for the scientific control of boiler pressure by the flue damper or forced draft.

And you can get both by equipping your plant with

Mason Regulators

For forty years, the Mason Regulator Company has specialized in the development and manufacture of dependable, automatic pressure regulating devices for the control of steam, air and water in all lines of service—heating, power and process.

Mason Regulators are conspicuous for accuracy, low maintenance and absolute dependability.



This Mason Reducing Valve will constantly maintain the required pressure, regardless of variations of pressure or volume at the source.

TRADE MARK MASON MASON

Write us today for catalog.

MASON REGULATOR CO.
BOSTON, MASS.

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ppers are built for automatic recording of coal eights, or they may be equipped with the usual scale arm tending downward within ie reach of the fireman on the oor.

The importance of including n the design of any coal handling system, no matter how imple, adequate and convenent means for weighing and ecording the amount of coal urned cannot be over-emphaized. Such records are essenial information from an perating standpoint.

For the hand-fired plant, vhere coal is delivered to the oiler house in trucks, barrows, ndustrial cars, or the like, here should be platform scales t least and a blackboard neary for chalking up the weights. The same applies to the deliv- ery of coal in railroad cars. In he latter case the weights can e taken on the yard scales.

Where automatic conveying machinery is used, automatic recording scales are available for registering the amount of coal passing over the system. The traveling larry with suitable weighing hopper inside the boiler house affords another means for weighing the coal as it is burned.

There is no one best coal handling system for all plants. Each individual plant has conditions peculiar to itself. The lay of the ground, the design of the building, the amount of coal burned, the kind of coal used and many other factors will exert their proper influence to determine what sort of coal handling system is best adapted to each plant. One thing is certain. For any given plant there is a system which will be simpler, more reliable, more economical than any other. That is the system you want.

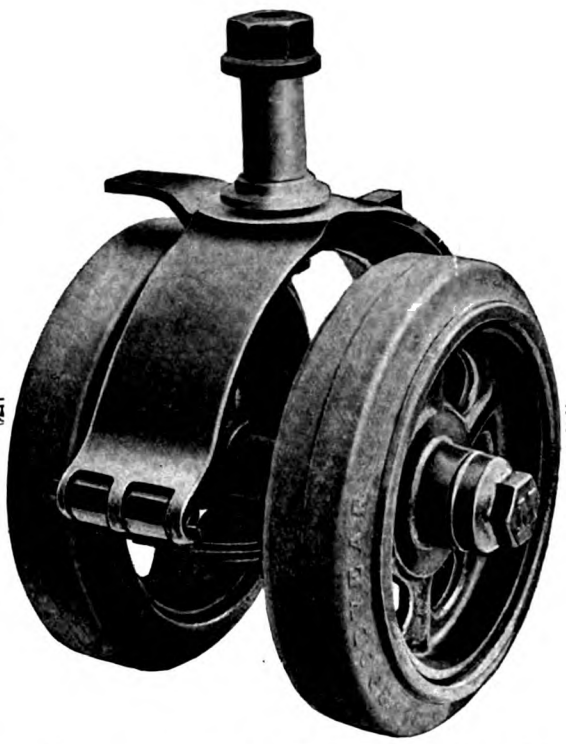
A strong plea for the education of industrial employees in the fundamentals of business economics and in the details of the businesses in which they are employed is made by Carl F. Dietz, president of the Bridgeport Brass Company, in a pamphlet recently issued by the Fabricated Production Department of the Chamber of Commerce of the United States.

The methods employed by Mr. Dietz's company are unique. Employees are educated through lectures and by means of simple visual illustrations. In the place of charts and graphs blocks of colored wood are used.

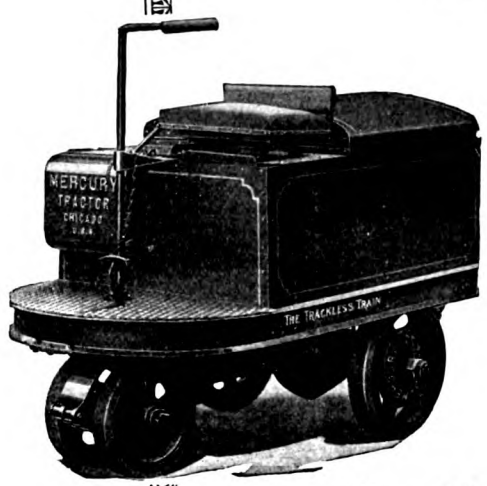
Workers who perform certain operations on materials before they have reached an advanced stage towards completion often show little interest in their work because they never see the start and finish of the job on which they are employed. There is manifest at all times, declares Mr. Dietz, a real desire on the worker's part to know more about the business in which he is employed. Far seeing managers, he adds, are seeking the best methods of imparting such information constructively, especially information regarding the relation of production to wages and the distribution of the dollar received for the product of the plant.

Copies of the booklet may be obtained by addressing the Chamber of Commerce of the United States, Washington, D. C.

Full Spring Suspension *in the* Mercury Type L-"Twin-3"



"Twin-3" front wheel assembly — an exclusive patented Mercury feature.

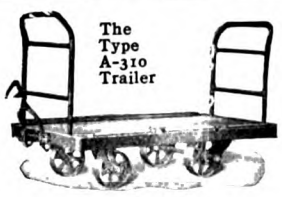


The Mercury Type L-"Twin-3"

THE importance of spring suspension for an industrial tractor can scarcely be over estimated. Springs make for long life and economical maintenance, because they cushion the working parts, and most important of all—the battery. In addition, springs assure constant steering and traction contact and comfortable riding for the operator.

The Mercury Type L-"Twin-3" is unique in its combination of all the desired features—simplicity, short turning radius, and full spring suspension, front and rear, on long period semi-elliptic springs. Hundreds of Mercury Tractors at present in service equipped with the "Twin-3" front assembly have conclusively proven the value of this feature.

There are four other types of Mercury Tractors to meet every industrial need.



The Type A-310 Trailer

TRAILERS

The Mercury Manufacturing Company also produces *good* Trailers for operation with Tractors in "trackless trains." This company was the pioneer in the industrial tractor field and for more than eight years has built nothing but Tractors and Trailers.



Mercury Manufacturing Company
4118 S. Halsted Street Chicago, U. S. A.

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U. S. Fuel Distributor Wadleigh Says:—
"Store Coal Immediately!"

THIS warning followed a report from the American Railway Association, which has advised that—

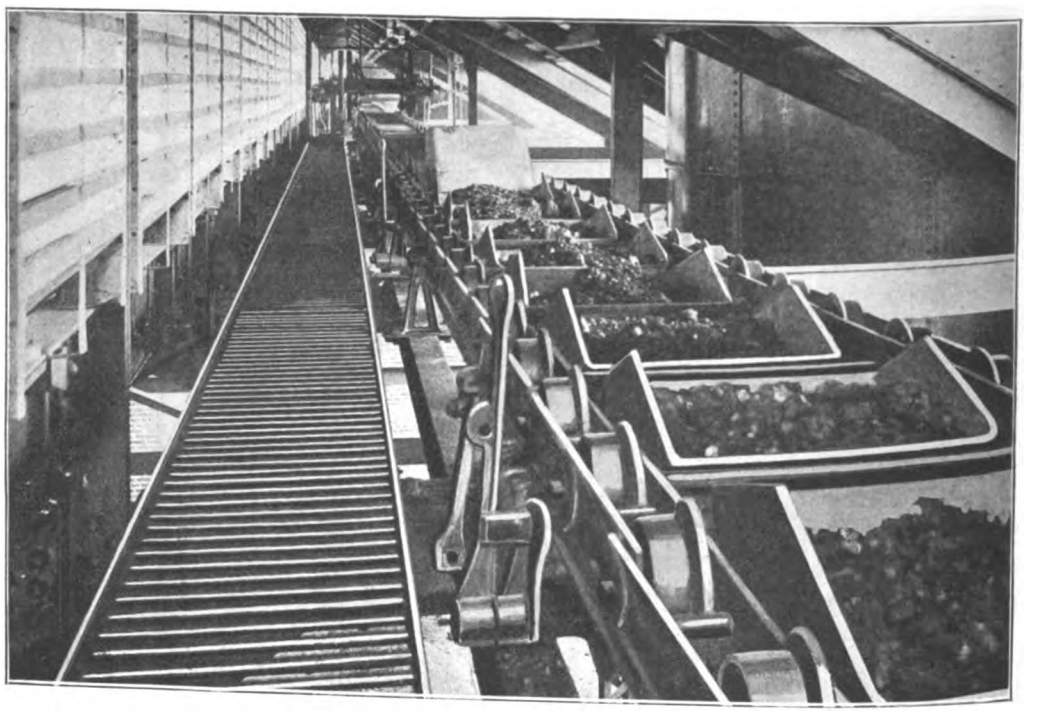
> ***"If coal consumers do not now purchase coal in anticipation of fall and winter requirements they will experience difficulty in procuring it later when railways are taxed with a heavy movement of general traffic, and particularly agricultural products."***

HERE is a warning to which every industrial user of coal should give instant attention. To heed this advice is to save many agonizing hours later on, when peak prices prevail and coal supplies are scarce. Coal is cheaper than it has been for a long time, and plentiful.

But don't let the storing and handling of your coal --and the removal of the resulting ashes--become too costly.

Hunt Cost Cutting Equipment is the result of over half a century experience in the economical, rapid, labor-saving and safe handling of coal, from barge or car to storage or boiler room hoppers, and the removal of ashes from the pits to car or storage.

Hunt engineers with their broad experience in meeting satisfactorily many difficult problems, and with their vast store of information to draw upon, can devise a suitable handling system that will expedite the storing of coal and lessen the cost of producing power. A word to them will bring an immediate response.



No. 04136
Upper run of the Hunt Conveyor over the coal storage bins. The same conveyor is used for handling the ashes.

A reading of Hunt Catalogues will convince Engineers, Superintendents and Managers of the wide possibilities of Hunt Cost-Cutting Equipment and the genuine satisfaction and savings resulting from its use.

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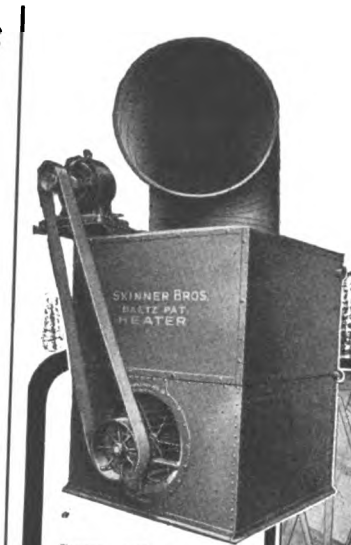
He Chased the Rainbow— Caught It—and Put It to Work

(*Continued from page 11*)

ent-day position in a list compiled by town-boosters from the census. Litchfield men and women are to be found in all parts of the country, and in positions of leadership wherever they are. When Frederic Ives was a boy there, in the days before it was submerged by the bigness of big cities, and before the old New England stock was diluted by the deluge of immigration, the Litchfield atmosphere had the opportunity in all its potency to saturate him through family, neighbors, playmates and schoolmates.

There is nothing fanciful in that statement. Why does Italy produce so many musicians? Is it not because the Italian atmosphere is musical? Its boys and girls all over the land from their infancy hear voices and instruments all around them making music of the highest order, so that it excites no comment—is not "queer"—when they, too, raise their voices in song, and ing song that is classical. So, here in America, the atmosphere is such that our boys naturally "make things" and are continually putting things together or taking them apart, to make new things. And if that atmosphere has any point of concentration, it is, or was, the state of Connecticut.

The evidence of it in Fredric Ives is that, after working on his father's farm, then in his father's store in town, and learning the printer's trade so that at sixteen he was a journeyman printer, he found the time and the means somehow out of his slender resources to follow his hobby of photography. It "got" him so completely that at nineteen years of age he went to Cornell University, not as a student, but to get a job in the photographic laboratory. He looked so much the awkward, hard-worked country boy that Professor Anthony, yielding to his



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General Motors Corporation, St. Louis, Mo., equipped with 16 Inverted Skinner Bros. (Baetz Patent) Air Heaters. Note fresh air inlets, dampered for re-circulation.



Industrial heating has actually been revolutionized by the Skinner Bros. (Baetz Patent) Heater—it is the original heater of its type and uses no outside pipes or ducts as warm air carriers. It distributes warmed air evenly throughout every portion of the open area of a building and also acts as a ventilator and air conditioner, either in Summer or Winter.

Think About Next Winter, *Now!*

DON'T *worry* about heat next Winter—*think* about it now and you will do as hundreds of others have done before. Install Skinner Bros. (Baetz Patent) Heaters and forget your heating troubles.

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(2) It will act either as a heater or ventilator or as a heater and ventilator combined. It can also be used as an air conditioner in connection with its use as a heater.

(3) It is quite economical to install and operate.

Think over this matter of heating and ventilating your plant—it is something that should have your attention now. Investigate the Skinner Bros. (Baetz Patent) system—send for catalog D-9.

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General Motors is only one of hundreds of large users of Skinner Bros. (Baetz Patent) Heaters. Ask us to send you the full list—it includes Ford Motor Co., Detroit Filtration Works, Crocker-Burbank Co., Federal Foundry, Lakehurst Naval Hangar, and others.

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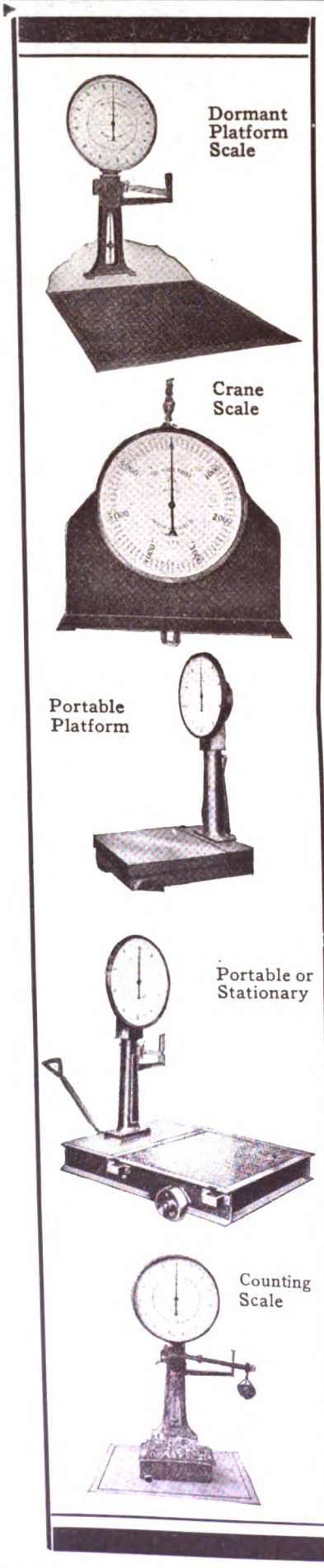
Skinner Bros.
***Baetz Patent* HEATING SYSTEM**

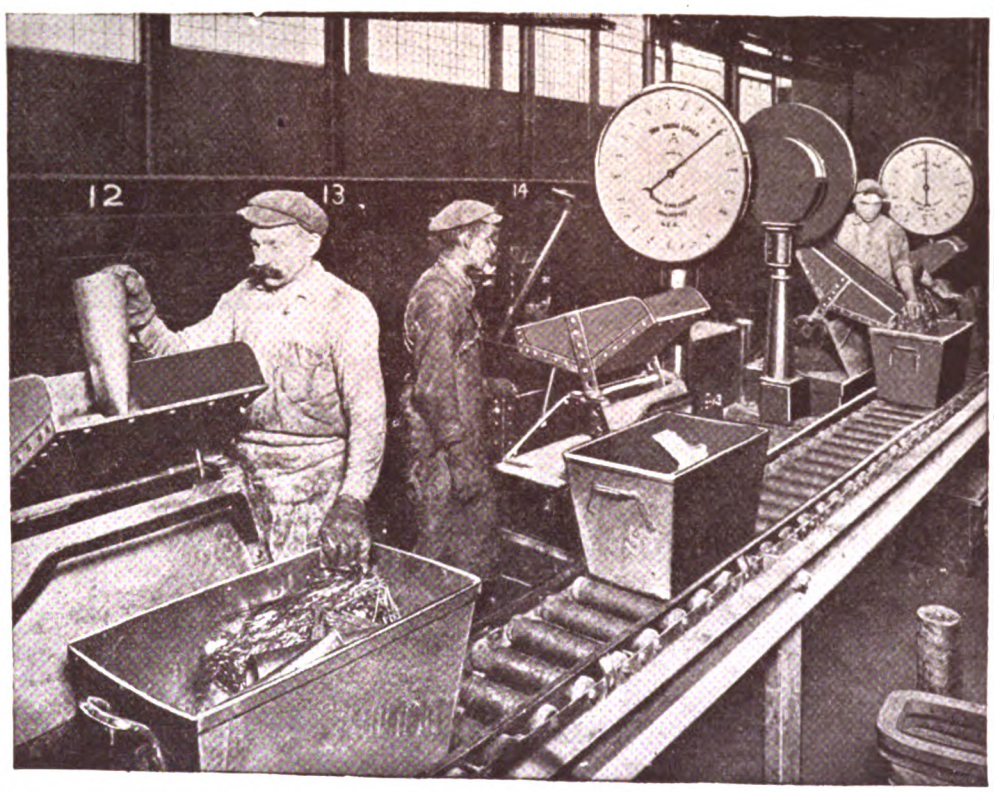
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importunity, put him to work as the surest way to eliminate him in the few days it would take to show up his unfitness. The few days lasted four years for the simple reason that no one else accomplished the things he did. He thus showed his good judgment by getting into a laboratory that was among the best in the country, where he would be sure of facilities he could not expect to get elsewhere both to learn what others were doing and to follow out the workings of his own eager mind in research and experiment.

So thorough was he in his endeavor to find a method of printing pictures that he undertook to learn wood-engraving. He did enough of it to give him an insight into the limitations of that art both in production and reproduction which made him all the more determined to substitute a mechanical process which should make possible the printing of photographs cheaply and in quantity on the ordinary printing press. He succeeded in a surprisingly short time, considering that he was only twenty-two years of age when he was able to patent the first practically successful process of half-tone photo-engraving. Other men in England, France Germany and the United States had been experimenting and patenting processes for over twenty years which were only partially successful. It was a noble line of predecessors in whose footsteps this Yankee boy trod. There were Niepce, Daguerre, Goddard, Claudet, whose names mark the milestones along the road which finally reached the goal of giving an inanimate plate the power of seeing equal to that of the human eye, and the power, exceeding that of the human eye, of retaining permanently the seen image. Then came the efforts to add still another power, that of multiplying the image for millions of other eyes to see. And later came yet another power, adding motion to the pictures; then color; then three-dimensional form; and lastly creating complete illusion by including the voice, music or other sounds of the scene. It is just a century since Niepce fixed his sun-pictures on silver-plated copper. In that century the whole road has been traveled. And no one man has carried the basic science and its application in practical mechanisms so far along that road as Frederic Ives. Take a shelf full of the yearly or half-yearly reports of the Patent Office running back to 1880 and in nearly every one you will find his name as a patentee, often more than once, sixty-five or seventy times in all. Most of his inventions have to do with optics, but along the way he found time to work out such other things as an oxy-hydrogen blowpipe, a saturator for blowpipes, a self-playing piano.

As early as 1852 a patent was granted to Fox Talbot for a method of breaking up a picture on a printing surface in such a way that it could be made to take the ink and print the picture. His finished plate was an intaglio, that is, the ink was taken up by the depressions in the surface and not the projections. He was sufficiently comprehensive, certainly, in the means he employed to do the breaking up. He used mus-





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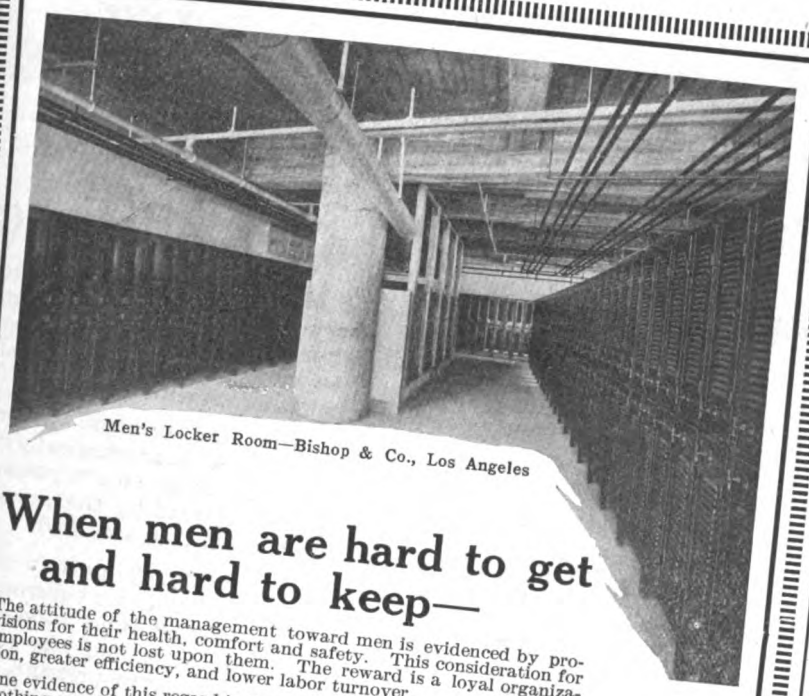
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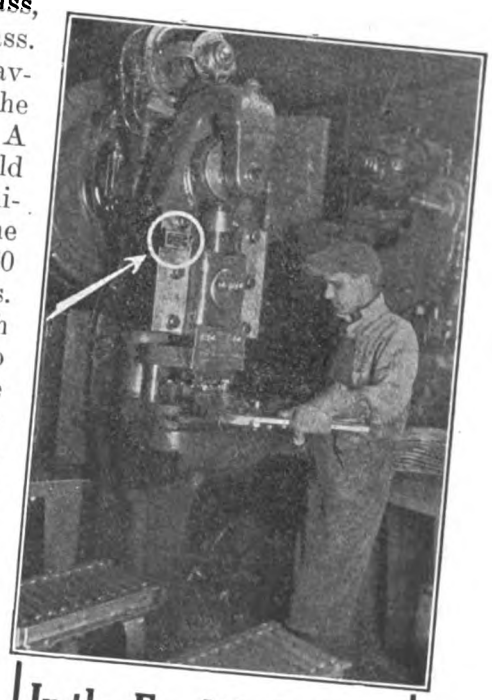


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STEELS SPECIAL PURPOSES WATERVLIET-N.Y.-U.S.A.

lin, crepe, fine lines on glass, or grains of powder on glass. In 1854 Paul Pretsch endeavored to accomplish it by the reticulation of gelatine. A year or two later Berchtold brought out a purely mechanical method of stippling the printing plate. Then in 1860 Asser used starch granules. Swan tried mixing grit with gelatine. Bulloch went back to the Talbot idea of using fine fabric, and Swan went a step farther by using Bulloch's screen, but moving it slightly during the exposure. So they groped. Ives, in 1878, while he was still in charge of Cornell's photographic laboratory succeeded where the others had failed, and produced the first half-tone process which was capable of commercial development. But even this success was only a beginning. It took him eight years more to achieve what he was really after and perfect the modern etched half-tone plate, with the stippled effect produced by means of a cross-ruled glass "pin-hole" screen interposed between the original picture and the printing plate with its sensitized surface. The plates he made by this first process were much the same when finished as the half-tone cuts that are now so familiar, but their production had several disadvantages. The stippling or breaking-up of the picture was accomplished mechanically by using a ruled elastic dotted V-line stamp inked and impressed upon a photographic relief instead of the cheaper, quicker and more effective operation effected by means of the pin-hole screen, which acted in a very ingenious and scientific way as an optical substitute for the mechanical V-line ruling. When he perfected this process Ives was in the employ of the Crosscup & West Engraving Company of Philadelphia, for whom he had established their photo-engraving plant in 1879. On their advice he did not patent his perfected half-tone process and thereby missed his chance of becoming the rich man he ought to be today, since his invention is in world-wide use.

But Frederic Ives wastes no time in bitterness or regret over what might have been. He gets his pleasure, as he says himself, out of being able to write "Q. E. D." at the end



In the Ford Body Shop Production Checked with model "B" Gear Counters

These give a reliable check on production. And the choice was R. A. HART Gear Counters after thorough investigation of the various methods used in industry for checking output per man.

In the body shop at River Rouge every machine is equipped with a model "B" Gear Counter and throughout the Ford plant 2100 HART Counters are in use. Cost of maintenance almost nothing.



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offer a reliable and accurate check on production and output. They show the figures at a glance, at any time.

They register up to 100,000. Constructed on gears—can be reset in a moment.

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And more of it. Production increases. And Davenport Wood Sole Shoes do keep the feet dry. If conditions in your plant are bad—if it is wet, damp, etc., Davenport Wood Sole Shoes will give you a chance to really hold your men by furnishing comfort and protection for their feet. Investigate these shoes.

Drop a line for full details.

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of his self-imposed problems, and then is willing to let the world enjoy the answer after he has put it in the back of the book. He's the sort who would enter the Olympic games for the laurel wreath and ignore the prize ring with its million dollar purse. He has not missed wealth by being a highbrow inventor with the usual "wheels in his head," and lacking business sense. He has deliberately put aside the commercial development of more than one of his creations simply because he doesn't want to stop by the way long enough to do that. It would take too much time from his work, his work being the study of certain deep problems in light and color and the development of appliances in that field for the uses of pure and applied science.

"How rich, how poor, how abject, how august,
How complicate, how wonderful is man!
How passing wonder He who made him such."

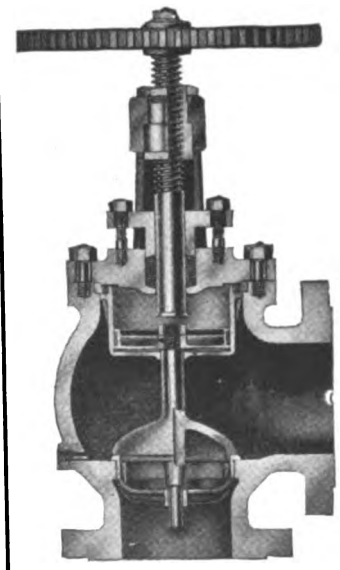
The farther we go in probing the works and the laws of the Creator, the more infinite we find the reaches before us. Once upon a time light had a simple definition. It was just the absence of darkness. Anybody with eyes knew what light was. "Darkness was upon the face of the deep....And God said, Let there be light; and there was light,....And God called the light Day, and the darkness he called Night." Simple. Any Sunday School scholar knew all about light. Light in nature, and the corresponding sense of sight in man, were provided so man could see his surroundings, distinguish the good from the dangerous, enjoy the one and avoid the other. Simple. Easy. But nowadays the single phenomenon, light, is so far from simple that while Einstein in one direction works on the problem of its material and ponderable character, and Roentgen demonstrates its action upon living tissues apart from the optic nerve, Ives will not pretend to know anything about light as Einstein and Roentgen know it. He studies and works with light along the path of its optical manifestations and effects, its color composition, its actinic power, the appliances wherewith he may

(*Continued on page 68*)

Made for maximum service not merely the average

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Jenkins Bros



Sectional View, Fig. 293 flanged, E. H Iron Body Automatic Equalizing Stop and Check Valve.

For safety— for boiler efficiency

JENKINS Automatic Equalizing Stop and Check Valve is designed to automatically shut off the flow of steam from the header to a boiler in case a tube should burst or other internal rupture occur.

It also equalizes the pressure between boilers in a battery, and automatically cuts in a new boiler when it gets up to pressure. Valve can only be opened by the pressure in the boiler to which it is attached.

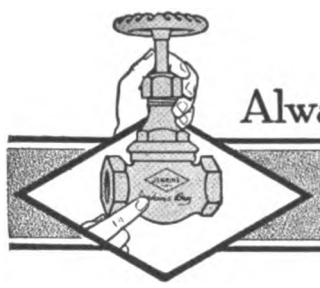
Made only in extra heavy pattern—iron body for steam—cast steel for superheated steam. They are strong, rigid valves perfectly adapted to withstand the severe stresses due to high steam pressure, and expansion and contraction of piping.

Valves in bronze, iron, and steel for all requirements.

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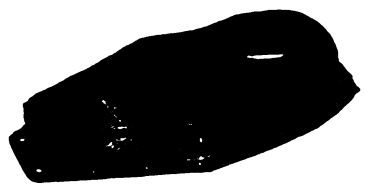
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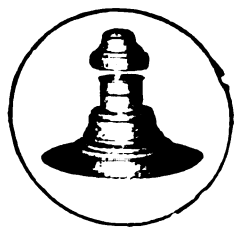


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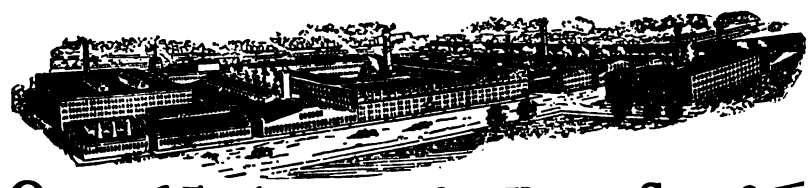
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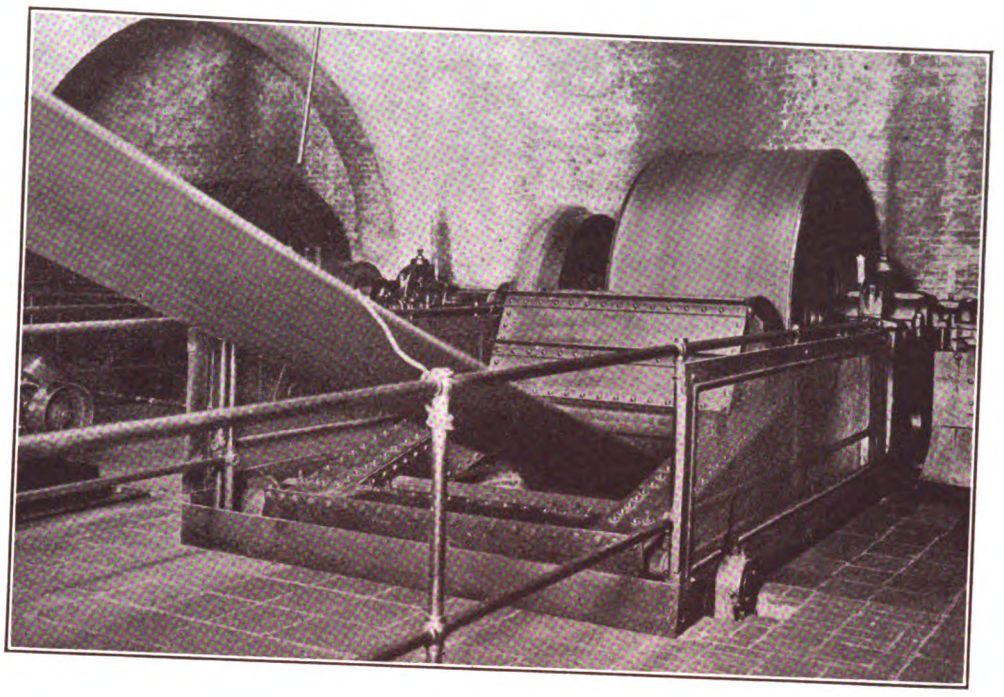
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Over 15 Acres of Floor Space—

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Point Number One—"Arc of Contact"

SEVERAL FACTORS must be taken into consideration in planning a belt drive to insure its successful operation. The most important of these is the *arc of contact* between the belt and pulleys.

An arc of contact sufficient to transmit the load may be obtained by two methods:

Natural—by the use of long pulley centers and slack belts, involving a large amount of floor space

Artificial—by the use of tension idlers or idlers of the flexible, resilient type when acting as belt wrapping devices, such as

THE LENIX DRIVE

A lack of floor space may prevent the use of the natural means. Where the necessary floor space *is* available it is expensive to use it for the purpose of giving long pulley centers to a belt drive. The disadvantages of the tension idler offset the benefit obtained through the slightly increased arc of contact it creates.

For eighteen years we have been building the "belt wrapping" LENIX DRIVE and are the pioneer manufacturers in this country of this type of drive.

At the plant of a brick manufacturer in New Jersey, a 1400 HP Corliss engine could not deliver more than 900 HP because, through lack of sufficient arc of contact, the belt would not hold on the lineshaft pulley when the load was raised about 900 HP.

A Lenix drive was installed and, as illustrated, is wrapping the 50", three-ply belt around practically three-fourths of the circumference of the lineshaft pulley, and the engine is now delivering its full capacity.

Booklet "Saving Slippage and Space" tells how it is done.

How belt tension is reduced, rather than increased, by the Lenix will be told next month under "Point Number Two."

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

F. L. SMIDTH & CO.

ENGINEERS

50 Church Street **New York, N. Y.**

THE LENIX DRIVE

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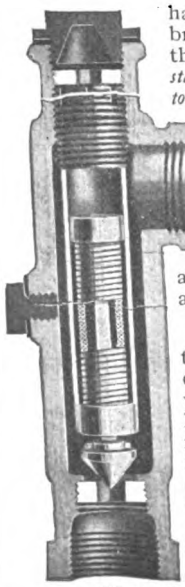
Don't turn Your Factory into a Store!

Most plants that use ordinary traps are virtually compelled to "keep a store" in order to maintain a supply of extra parts sufficient to take care of repairs. For some bucket traps have as many as 43 parts that may require replacement. This not only means a lot of money tied up, but it means that you are paying someone to *make the repairs!*

The Steam Trap Sarco, on the other hand, has but five parts, and only one that moves. Consequently, there is practically nothing to wear out and require replacement in the simple

STEAM TRAP SARCO

Another thing, most concerns keep a few extra traps on hand for emergencies. Here again the Sarco saves money as it costs about one-third the price of bucket traps.



The next time you have a steam trap breakdown remember that *it costs less to install a new Sarco than to repair a worn out bucket type trap.*

Hence, in most cases, you actually save money by scrapping your old trap and replacing it with a brand new Sarco.

The Sarco drains the condensate as quickly as it forms with minimum loss of heat, instead of permitting it to collect in volume and cool off. Saves valuable heat units.

Made in sizes from ¾ in. to 3 in., for pressures up to 200 lbs.

Write for Booklet R-32 and particulars of our 30-Day Free Trial Offer.

SARCO CO., INC.

236 Broadway,
New York City

Buffalo Chicago Cleveland
Detroit Philadelphia

(*Continued from page 66*)

employ it in the form of transmitted or reflected light to reproduce the image of the natural object, still or in motion, flat or solid, in monotone or color, of actual size or magnified or minified. That's work enough for one man in one lifetime. In fact, a lifetime is not time enough.

Much of Mr. Ives' work is little known to the general public, and much that is known is not known by his name; the half-tone, for example. Scientific societies bestow fellowships and medals upon him for such discoveries and inventions as the parallax stereogram, for instance, but what man in the street, passing the "changing pictures" in the store windows wherein the pretty girl is seen sucessively smiling and frowning, knows that he is looking at an adaption of the invention with the scientific Greek-Latin-English name? As seen in the physical laboratories of institutions of learning, the parallax stereogram is a stereoscopic picture without a stereoscope; a photographic print on a flat plate of glass which, when held at arm's length, "stands out" in perfect relief. That was a sufficiently remarkable accomplishment to call forth medals from the Royal Photographic Society and the Franklin Institute. But if it has commercial possibilities beyond his modification of it in the familiar "changing pictures" for advertising purposes, somebody other than its inventor will have to discover and apply them. He is busy, too far ahead on the road to other things.

While we are on his more purely scientific productions, there is the modern high power binocular microscope. Ask the research chemist or physicist how useful that instrument is to him in studying certain effects upon the structure of materials during the processes of experimentation or testing. One does not have to be so very old to remember that in his study of physics there was just one way to get a solar spectrum, and that was by refraction with a glass prism. But, like many other things of the good old times, the prismatic spectrum, pretty as it was, had serious faults. It didn't tell the truth. Due to the varying



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STRONG AND DURABLE

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A factory expert is in your territory. He would like to talk it over with you.

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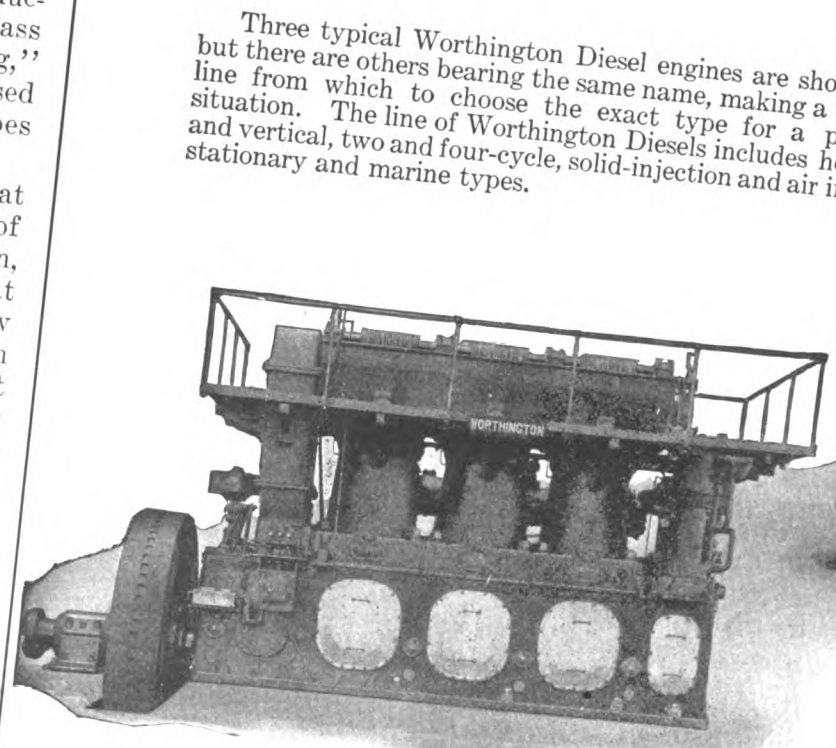
refrangibility of the light rays of different colors, it crowded the bands of light toward the red end, and spread them toward the violet end. Professor Rowland, of Baltimore, broke up white light into its constituent colors by ruling fine lines, tens of thousands to the inch, on a smooth surface. The minute corrugations interfered with the wave-lengths so they were separated and regrouped into color bands as in the prismatic spectrum, but with the important difference that the width of the bands was in true proportions. Mr. Ives multiplied the use of the Rowland diffraction grating, making it immensely more serviceable to the scientific and industrial world at large by cheapening it without sacrificing its accuracy. Rowland used a metal surface; Ives reproduced the surface as a "glass sealed diffraction grating," and the Ives gratings are used in laboratory spectroscopes the world over.

But here is something that solves an age-long problem of simpler appeal. What woman, and what archeologist, for that matter, would not like to know exactly the shade of Tyrian purple? When I say scarlet do you see vermilion? Two or three shades lighter means one thing to me, and another to you. We cannot match a color without putting the two objects side by side and then trusting to the trueness of our eyesight, which may easily be made doubtful by varying light intensity, by different surface, texture or material. But this master of light and color has forever leashed the elusive color-quality of light, he has eliminated another factor of the human equation, he has lifted us out of dependence upon the keenness of one of our senses to the solid footing of scientific, mathematical unchangeable certainty. With the Ives colormeter, colors can be matched though they be on opposite sides of the world; a century after they have faded they can be reproduced exactly. The instrument gauges a color or a tint by its hue and intensity with entire precision and registers it by a combination of three numerals. It is capable of a million variations in color and shade. The registered number being sent to another person with a colorimeter, he has simply to set his instrument to the given number, and the resulting combination on the color register will be exactly the same as that on the first instrument. And the result will be identical anywhere and for all time. Naturally this instrument should be of immense value in laboratories and industries wherever color plays an important part.

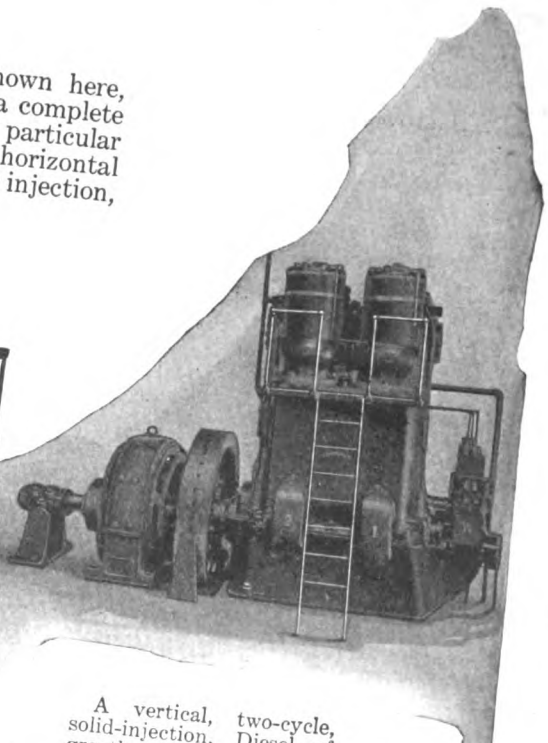
Countless commercial and experimental operations require exact identification of colors and shades. Heretofore there has been only a nomenclature in which there were lamentably few terms of fixed meaning having exactly the same significance to the senses of all who used them. For the remainder, words have been borrowed from all sorts of sources and used more or less sensibly or fancifully according to the taste, usually, of the coiner. "Orchid" on one color card might be "Honeydew" on another. "Sea green" and "Pea green" might be nearer alike than their spelling. But now Ives has made all that

Worthington Diesel Engines
A type for every service

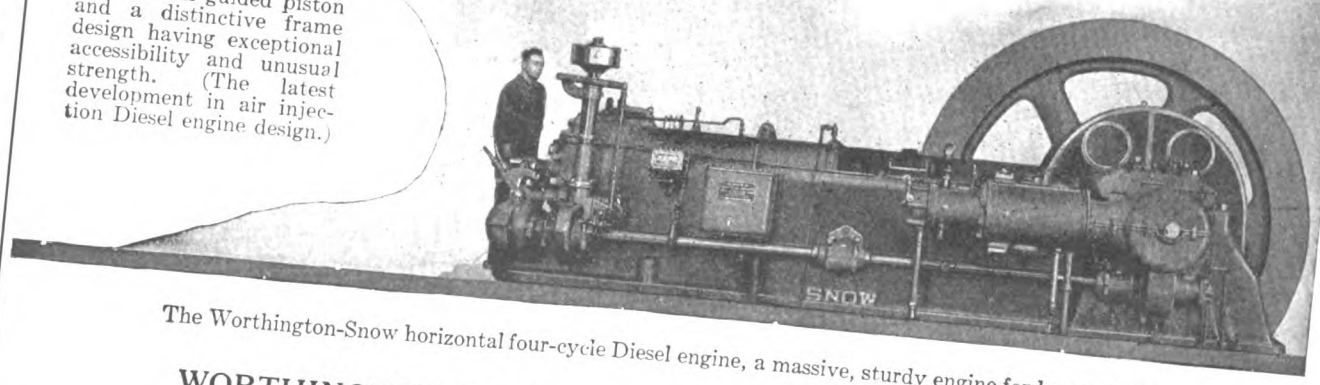
Three typical Worthington Diesel engines are shown here, but there are others bearing the same name, making a complete line from which to choose the exact type for a particular situation. The line of Worthington Diesels includes horizontal and vertical, two and four-cycle, solid-injection and air injection, stationary and marine types.



Vertical four-cycle Diesel engine with guided piston and a distinctive frame design having exceptional accessibility and unusual strength. (The latest development in air injection Diesel engine design.)



A vertical, two-cycle, solid-injection, Diesel of greatly simplified design.



The Worthington-Snow horizontal four-cycle Diesel engine, a massive, sturdy engine for heavy duty.

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Executive Offices: 115 Broadway, New York City. Branch Offices in 24 Large Cities

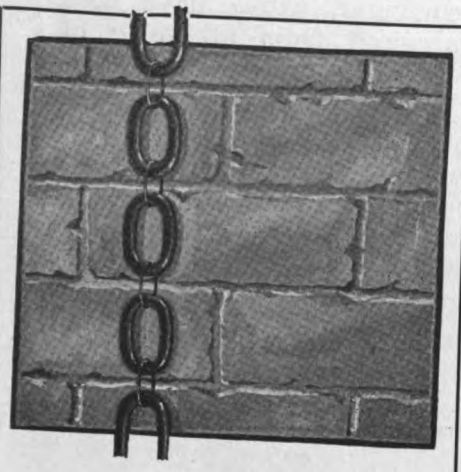
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Those weak links in your furnace lining—

Eliminate them with PLIBRICO

THINK of your fire brick furnace lining as a chain—a chain of brick and cement. Each brick is a strong link; each joint is a weak link. You can increase the strength of the strong links by using better fire brick—but you can't increase the strength of the joints unless you *eliminate* them.

Plibrico has no weak links—no joints. Every part of it is as strong as every other part—and every part is the highest quality of refractory that it is possible to produce. That is why engineers have said that Plibrico could be sold at a price far above its present moderate cost and still be the most inexpensive of furnace linings.

Plibrico saves in application cost—because it is plastic, adaptable to all furnace forms, and is effectively applied by inexperienced labor. It saves in furnace maintenance costs because it outlasts brick linings and can be readily repaired.

It builds up further efficiency because it stops leaks and will stand forcing temperatures to 3100° F.

The extensive book "Modern Furnace Building" tells the story.

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Warehouse stocks are carried in fifty-two cities.

PLIBRICO FURNACE LINING

JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

This 50-page book **FREE**



Jointless Fire Brick Co., 1154 Clay St., Chicago.

Please send me the 50-page booklet, "Modern Furnace Building"—no obligation.

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obsolete. No one has to depend on recollection or figures of speech or reference to other colors in nature to visualize or describe the color and shade of the yellow band of light in the spectrum; it is identical in India and Indiana. The wave length will be the same in the twenty-fifth century as it was in the fifth. So, when the Ives colorimeter tags it with a number, mixes it with other eternally fixed colors, tagged with equally invariable numbers, he has achieved for this phenomenon, which from the beginning of time has been only an elusive sense perception, an exactitude practically equal to that of astronomy. The colorimeter is not yet in wide use because for quick industrial laboratory standardization purposes Mr. Ives provided his much simpler "tint photometer," which quickly measures colors without matching them to the eye, and is used successfully even by the partly color-blind. Hundreds of Ives' tint photometers are now in use in industrial laboratories.

Now, having disposed of his minor inventions, we have a clear track for following Mr. Ives' lifelong work on color photography and color-printing, the latter of which at least has had important industrial and artistic results. On the former he is working toward results which he believes will transcend in universal interest anything he has ever done. Research in "heliochromy," "sun-coloring," goes back well into the nineteenth century. Some of the very earliest attempts at photography achieved it. Indeed, it was never in the mind of some of the original experimenters that the picture should be in black and white, any more than that it should be a negative: their objective was a positive in natural colors. The renowned Clerk Maxwell delivered a lecture before the Royal Institution in 1861 on color photography and illustrated it with lantern slides, one of which had taken the blue tints of the scene, another the red and a third the green. On the three slides being superposed, the resulting picture, shown with transmitted light, appeared in approximately true colors for the most part. Others made experiments, but did more theorizing, without achieving dependable

DEPENDABLE SERVICE

It is quickly becoming recognized that Detroit Belt Lacing makes the nearest possible approach to an endless belt. Greater strength, more flexibility, easier to apply, longer service, saves time, belts, power, money and annoyance—Detroit Belt Lacing is not altogether thought of as a mechanical device, but in terms of dependable service.

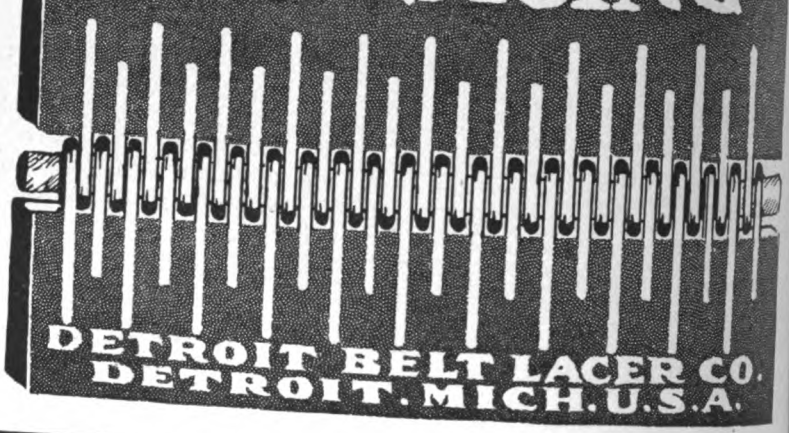
Hooks in Long Sections—12"—Less Waste
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9 Branches Carrying Stock—Prompt Deliveries
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Technical information gladly given—ask for card "Right Size of Hooks"



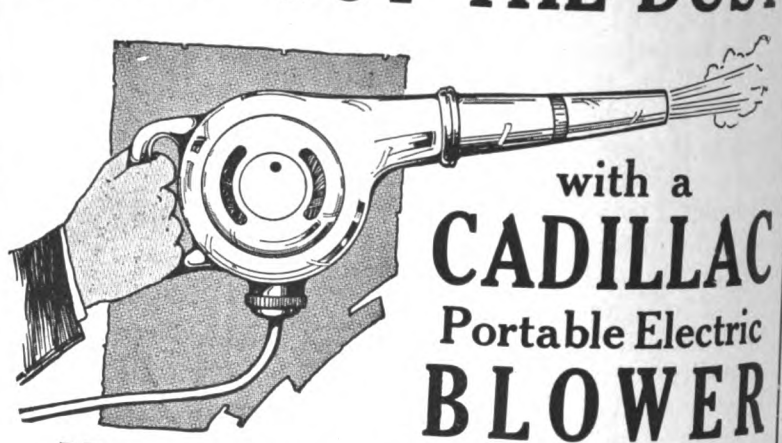
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BLOW OUT THE DUST



with a
CADILLAC
Portable Electric
BLOWER

Keeps Machinery Clean

The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc. Complete in itself and requires no expensive installation or equipment.

Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories and every line of industry.

Write for descriptive folder giving prices and testimonials by leading manufacturers.

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Manufacturers of the
Cadillac Electric Vacuum Cleaner
612 Fulton Street CHICAGO
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Cleaning small motors. No condensation to short circuit motor and no excessive pressure to injure windings or insulation.

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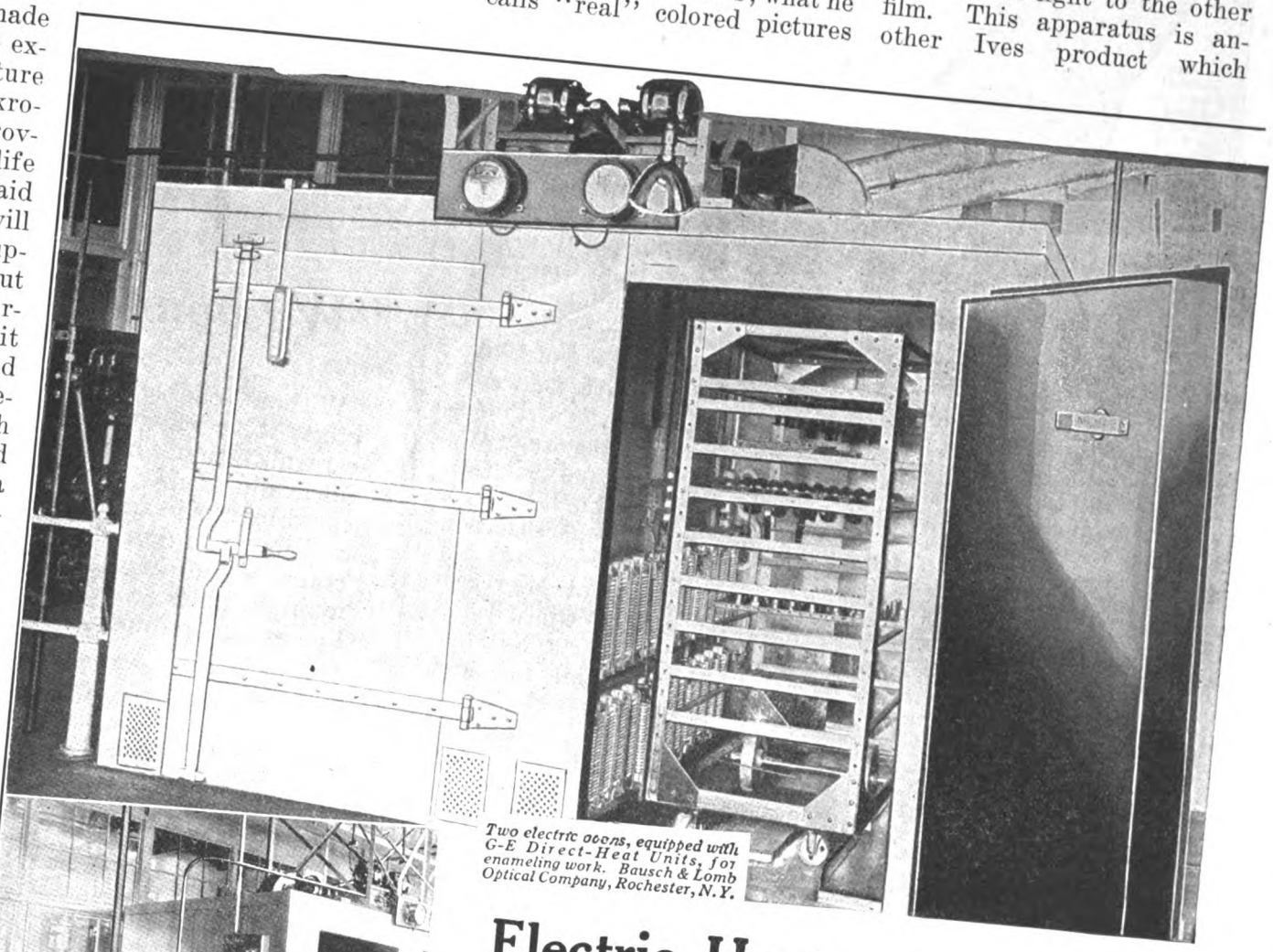
SERVICE
Belt Lacing makes the
Greater strength, more
"Detroit"
No. 6
Closing
Machine
DIT
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DUST
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results. But Ives, who did his theorizing in his laboratory as a basis of experimentation, was able, in February, 1888, to photograph the spectrum in its true colors and brilliancy. Before the end of the year he had progressed to where he was photographing compound colors. By means of a remarkable plate, sensitized to the three fundamental colors, used in a special camera which made a triple photograph at one exposure, he produced a picture which, when placed in the kromoscope, as he called it, proved to be startlingly true to life in color and form. It is said that probably its results will not be materially improved upon, so perfect are they; but special instruments are required, the picture is small, and it must be seen by transmitted light, whereas the popular demand is for color photograph on paper. Consequently it did not develop successfully as a business venture. But, as usual, it brought honor and medals from fellow scientists and scientific societies.

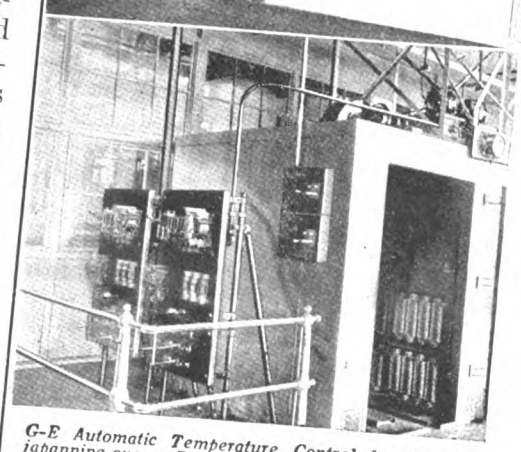
His discoveries made in the course of developing color photography, however, did have the important industrial result of laying the correct foundation principles for color printing. In a short time he had evolved the three-color half-tone printing process, thus giving to the printed page, with three impressions, a complete color range, practically equal to the best in lithography and without the high degree of skill and the expense required in that art. The process is so well known now to every school-boy that a description would only make wearisome reading, to be skimmed over and very likely skipped over. Our admiration now is reserved more for the speed and accurate "registration" of the printing press than for the more profound achievement which made it possible for the printing press to do such work at all. Only its every day familiarity warrants dismissing it with this brief paragraph, since actually the three-color half-tone is a great milestone in the progress of that art which is the great disseminator of knowledge and culture.

All along, with the study and solution of the greater problems, Mr. Ives has perfected his tools, inventing and patenting incidental improvements to the mechanism of his art. Now it is a plate-holder, again it is a special camera. Then there is a film pack, an improvement in film, a reflector for use in taking microscopic photographs. Three-color photos by the Ives process can be taken with the Ives hand camera.

Could such a man do all he did with photography and colors and not attempt to apply his ideas to the motion picture? In 1916 he was granted a patent for motion picture apparatus and another two years later. Nineteen-nineteen saw him projecting motion pictures in their natural colors; what he calls "real" colored pictures not hand-painted or otherwise doctored, but with the color in the photograph, the film itself. Two negatives are taken in two cameras through a di-chromatic screen which is puzzling to the layman, since it transmits red light to one film and reflects green light to the other film. This apparatus is another Ives product which



Two electric ovens, equipped with G-E Direct-Heat Units, for enameling work. Bausch & Lomb Optical Company, Rochester, N.Y.



G-E Automatic Temperature Control for electric japanning ovens. Bausch & Lomb Optical Company, Rochester, N. Y.

Electric Heat Reduces "Rejects"

These electric japanning ovens, equipped with G-E Direct-Heat Units and Automatic Temperature Control, have reduced the number of "rejects" from 50% of the total amount of parts formerly baked in fuel heated ovens to 4% of the same total material now baked electrically.

This in itself is an appreciable saving, but there are other economies based on the high quality of the finish and the increased volume of work which must be accredited to G-E Direct-Heat Units—for they supply heat directly to the charge with an intensity that is perfectly applied and controlled.

G-E Direct-Heat Units are easily installed on large or small japanning ovens—and their flexibility makes possible the most desirable location of each individual heating unit.

G-E Industrial Heating Specialists will gladly make recommendations covering the installations of electric heating equipment for many heating processes in your plant.

General Electric Company
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Sales Offices in all large cities

GENERAL ELECTRIC

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No. 644 Gauntlet Glove, reinforced with flexible steel ribbons clinched over strips of tough leather. Extra leather patch on the thumb. $18.00 per dozen pairs.

Less Labor Turnover with Hand Protection

Try a few pairs of Steel-Grip Industrial Gloves. You can hardly realize how well they are made—how thoroughly they protect the workers' hands and give them added assurance of hand protection.

STEEL GRIP
MADE IN CHICAGO

Industrial GLOVES

are especially made for industrial use for men who handle castings and other rough materials in shops, foundries, mills, scrap yards, mines or smelters.

They are built up of three wearing surfaces and a comfortable felt lining—flexible steel ribbon reinforcement clinched over tough strips of leather and strong steel thread stitching. No danger of seams ripping, burning or tearing out.

Steel-grips will help in lessening labor turnover.

Our catalog describes the complete line with suggestions for the proper gloves for the various requirements. Send in your order for a dozen pairs on trial and the catalog.

INDUSTRIAL GLOVES CORP.
1201 Fullerton Ave. Chicago

Try a dozen Pairs



No. 605 Short Glove, steel ribbon reinforcement and extra wearing patch in palm. $16.00 per dozen pairs.

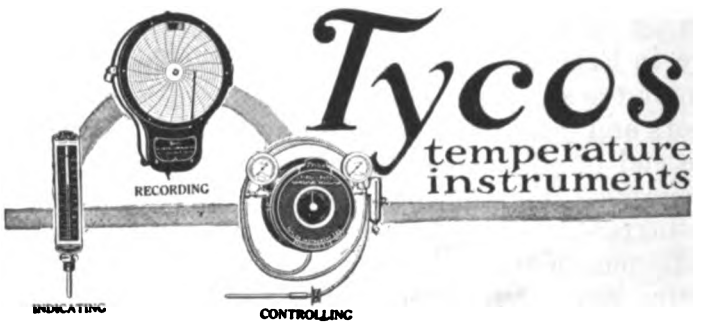
awaits commercial development and exploitation. (Now imminent.)

Most of us can spend the better part of a lifetime learning what there is to know about some one object, how to make it or how to sell it. The Ives mind, on the extreme contrary, not only gives birth to the hitherto unknown, but is so fecund that it can come pretty near abandoning some of its progeny, at least can leave their thorough development to a later time or other hands. He is equally prolific as a medallist, so that very likely he could lose some of them and not miss them. They come from his home city of Philadelphia, the Franklin Institute, the Photographic Society of Philadelphia. They are showered upon him by the Royal Photographic Society, the American Academy of Arts and Sciences. Memberships and fellowships, too; the American Association for the Advancement of Science, the Royal Microscopic Society, the Medical Institute of Graphic Arts, National Institute of Social Sciences, the American Physical Society, the American Philosophical Society, the Academy of Arts and Sciences and others.

The voluntary establishments of standards of quality in industry forms the subject of a pamphlet which has just been printed by the Fabricated Production Department of the Chamber of Commerce of the United States.

There has been a growing interest for some time in the establishment of quality standards, says the department, which calls attention to the fact that a recent canvass of trade associations discloses that many have set up standards and that still others have provided guarantees of quality in backing up the products of their members.

"Quality and quantity standards," says the pamphlet, "are essential for the free interchange of commodities in commerce beyond the stage of first-hand transactions in which personal observation and opinion govern. Progress in civilization is measured by commerce, so standards are at the base of civilization as well as of commerce."

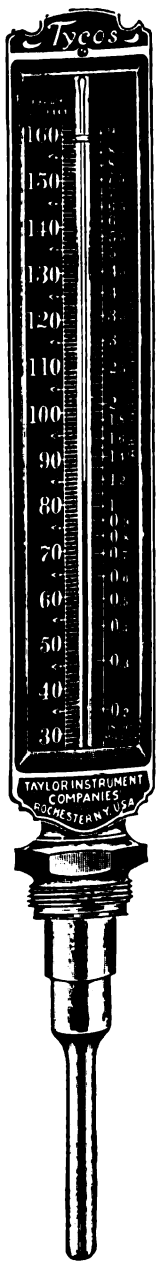


Tycos
temperature instruments

A LETTER WORTH READING

This letter was written by the efficiency engineer of one of the largest and latest modern power plants in this country.

"We bought 152 of them"



"Without reliable indicating thermometers, the efficient operation of a central station is impossible. Our confidence in *Taylor* instruments is indicated by our installing 152 of them in our power station for indicating temperatures vital in the operation of the main turbines, condensers, hot wells, boiler feed pumps, oil coolers, transformers, etc.

We have just installed a 60,000 K. W. 3 element, cross-compound turbo-generator, which is one of the largest units in the world. The outstanding variable affecting the efficient operation of this unit is the vacuum. The *Taylor* instrument has been chosen for the important work of indicating the vacuum on this tremendous unit, which uses so much steam that a reduction of 1% in its efficiency means a loss of about 6,000 lbs. of steam per hour.

"The 2 instruments indicating vacuum have 2 scales, one for absolute pressure in inches of mercury, the other for temperature in degrees Fahrenheit. This dual scale is a great convenience. While it is impossible to prove increased efficiency due to these indicating instruments, it should be perfectly obvious that the important processes in this plant could not be properly controlled unless the situation was constantly shown by reliable instruments. We would not consider designing a plant without including such equipment."

A copy of this letter containing the writer's name may be obtained by referring to this advertisement.

Have you a copy of the *Tycos* General Industrial Catalog on your desk or in your library? If not write for one today.

Taylor Instrument Companies

Rochester, N. Y., U. S. A.

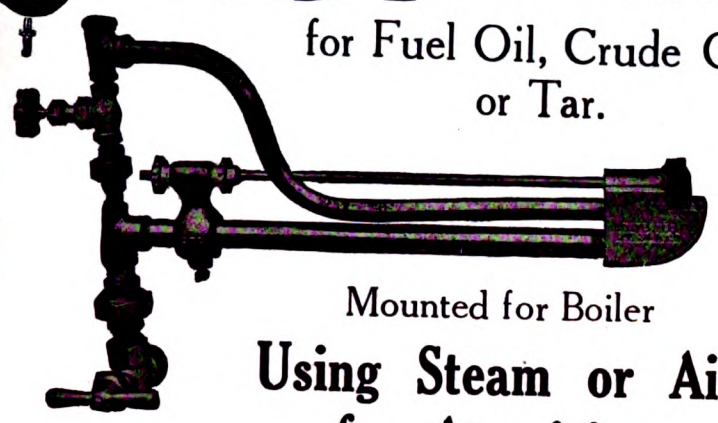
Canadian Plant, 110-112 Church Street
Tycos Bldg., Toronto.

There is a *Tycos* or *Taylor* Temperature Instrument for every purpose.

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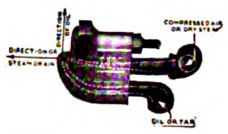
CALOREX Burners

for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



CALOREX
Unmounted

Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing.* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

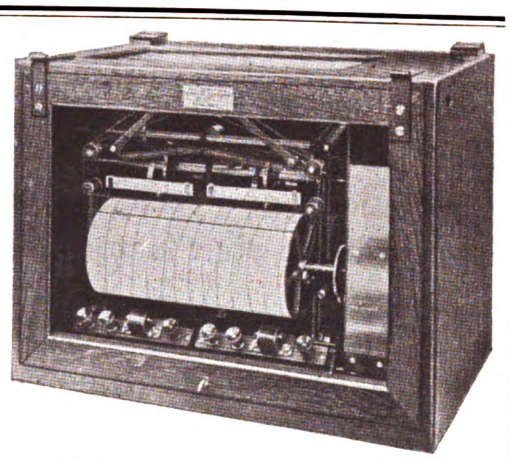
The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

Write for catalog.

W. N. BEST FURNACE & BURNER COMPANY
11 Broadway ENGINEERS IN CALORIC NEW YORK
There is nothing better than the Best

CO_2 Readings from 4 Boilers on the One Chart



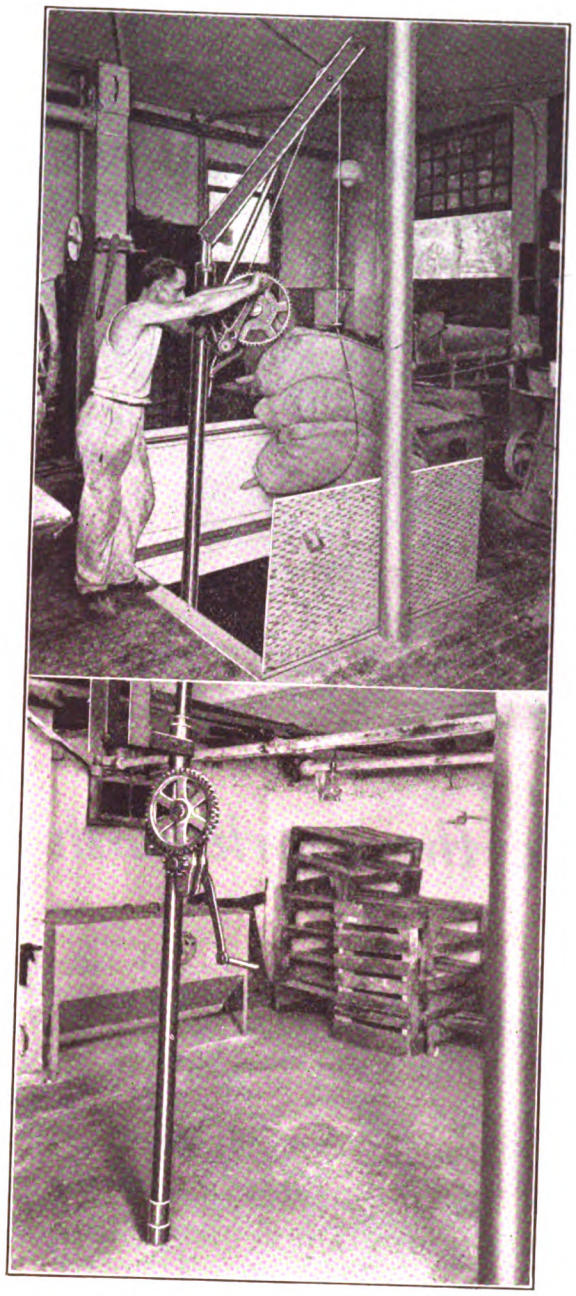
Helps Solve an Important Boiler Room Problem

A 4-Point CO_2 Recorder—one of the types of Cambridge Recorders, made to show the comparative efficiencies of four boilers.

CAMBRIDGE ELECTRICAL CO_2 RECORDERS INDICATORS

Save time by having a continuous record of boiler performance right in front of the operator.
They are entirely electrical—no chemicals to renew—no glass or rubber parts to break or wear out. Can be installed any distance from the flue. As accurate as an Orsat with none of its faults or maintenance troubles.
Other Cambridge instruments—Electrical Distance Thermometers. Thermo-electric Pyrometers, Optical Pyrometers, Draft Gauges.
Send for List 157 X.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC)
MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY



Put a G & G Hoist to work—and Save Labor—

FOR raising and lowering boxes, bales, bags, floor trucks, etc. between floors—and for the removal of ashes from cellar to street without rehandling at grade level.

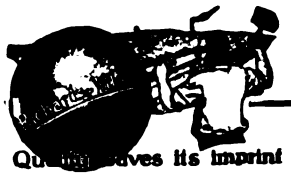
Write for illustrated Booklet "Industrial Plants Need This Hoist." It tells you why.

GILLIS & GEOGHEGAN
556 West Broadway New York

the **G&G**
REG. U.S. PAT. OFF.
Telescopic Hoist
with Automatic Gear Shifting Brake Device and Silencer

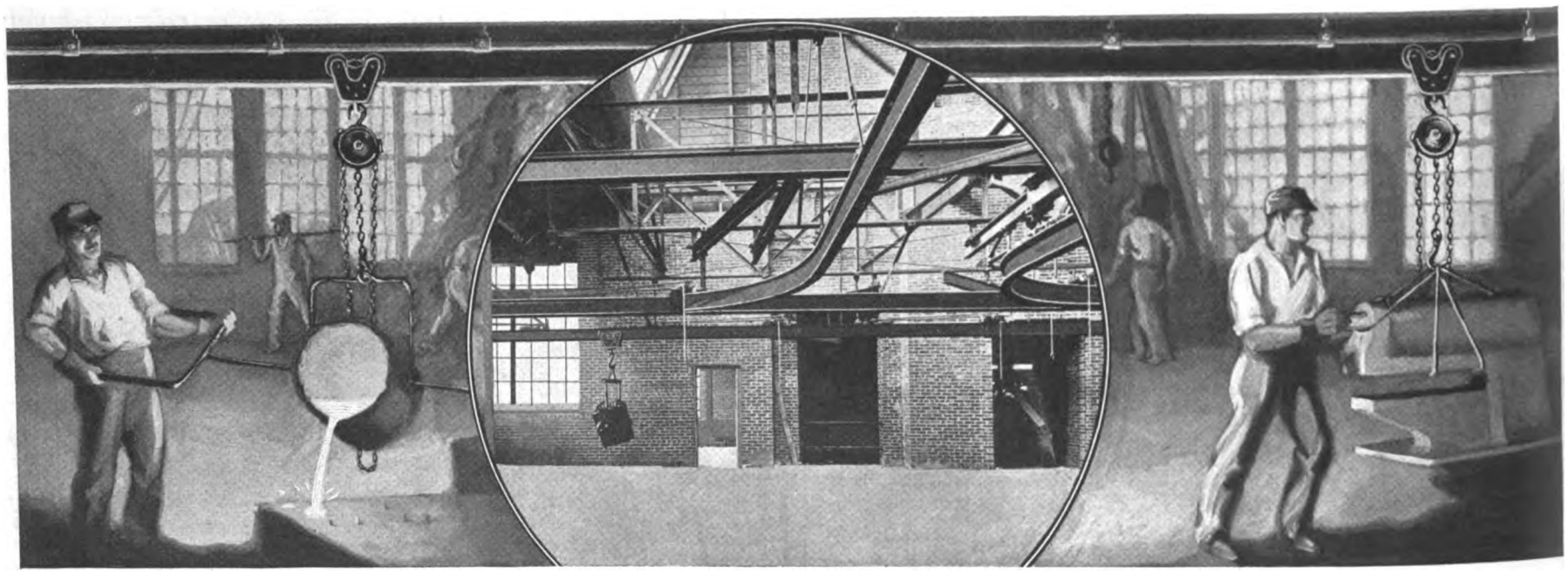
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RICHARDS-WILCOX R-W AURORA TRADE MARK



Handle the work with OVERWAY *from start to finish*

Nothing is so unnecessarily wasteful as the use of costly man-power for conveying raw materials and finished products about a plant. It slows up production, adds to labor costs and seriously decreases profits.

In hundreds of notable manufacturing plants, *OveR-Way Conveying Equipment* is repeatedly repaying its moderate first cost by enabling one man to do the work of six. In the foundry, for example, it transports huge bull ladles with ease and absolute safety. It handles heavy castings through machining and painting operations, and speeds them to warehouse or shipping room. There is hardly a handling operation in your factory that can't be done more economically with *OveR-Way*.

R-W Ball Bearing I-Beam Trolley

Rigid tests have demonstrated that the *R-W Ball Bearing I-Beam Trolley is* by far the most durable, most efficient and most easily operated trolley for foundry use. As an example of its ease of operation, a 1-ton load can be started with a 30-pound pull as against a 200-pound pull required to start a competitive trolley. Yet this is only one of many exclusive features, others being the dust-proof ball bearings, crowned wheel treads, improved lubricating system, safety bumpers, and short wheelbase.

Free Engineering Service to Manufacturers

Our Engineering Department has solved conveying problems for practically every type of business. We can tell how *OveR-Way* can be adapted to your peculiar requirements and submit complete plans and specifications, including estimated savings. This service is given without cost or obligation to any manufacturer who earnestly desires to modernize his plant, increase speed and quantity of production, and lower costs. Write for details of this service and a copy of Catalog DD-23.

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"A Hanger for any Door that Slides."

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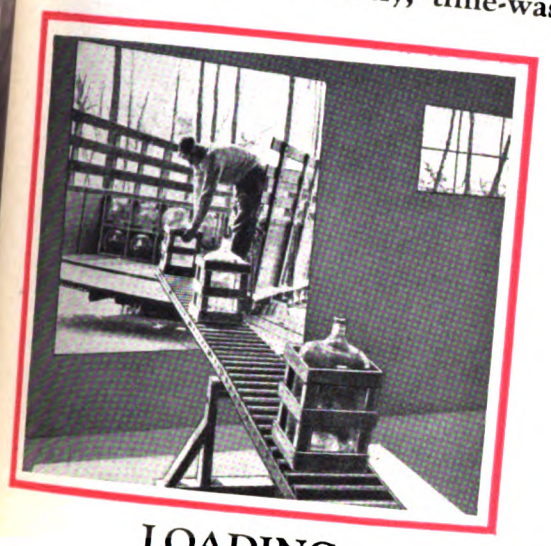
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Are you short of labor?

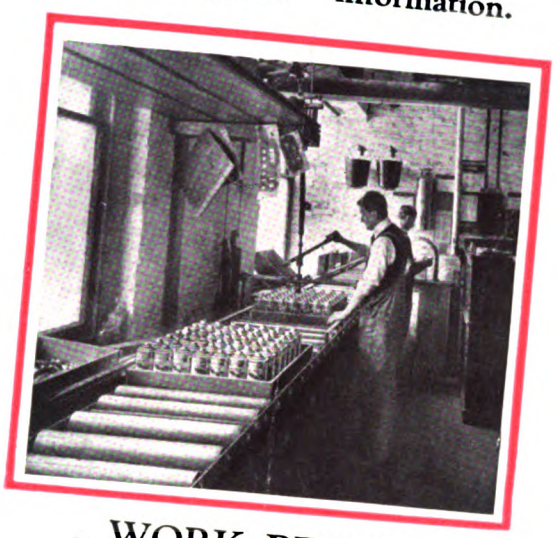
With wages of move-men nearly doubled, and the men almost impossible to hold at any price, Lamson Conveyors offer quick and sure relief. Conveyors keep things moving in your plant; they do away with the costly, time-wasting blunders of green move-men; and, best of all, each conveyor releases men for more important productive work.

Here are five remedies for the labor shortage in your plant. A request will bring more complete information.



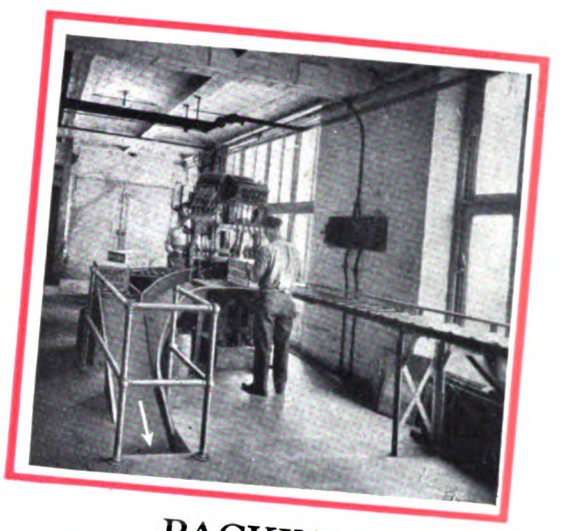
LOADING

Conveyors will save at least one man wherever products are loaded and unloaded.



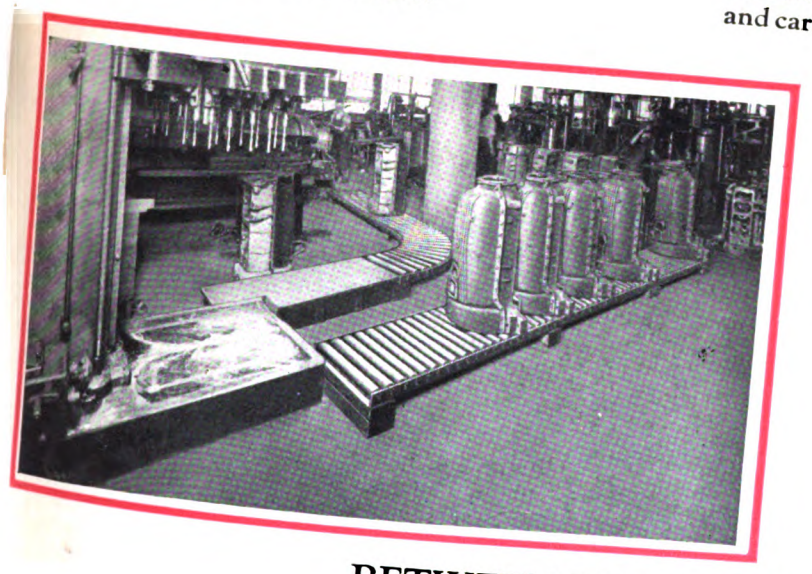
WORK-BENCH

One man does the work of two wherever materials are brought and carried away by conveyors.



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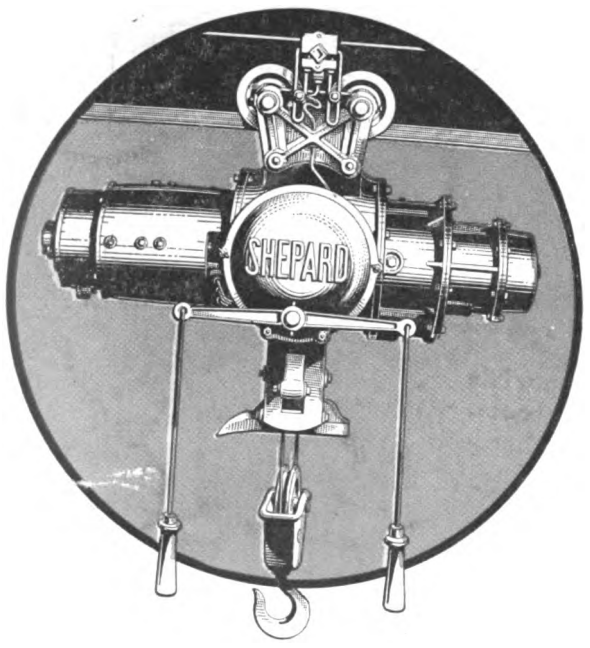
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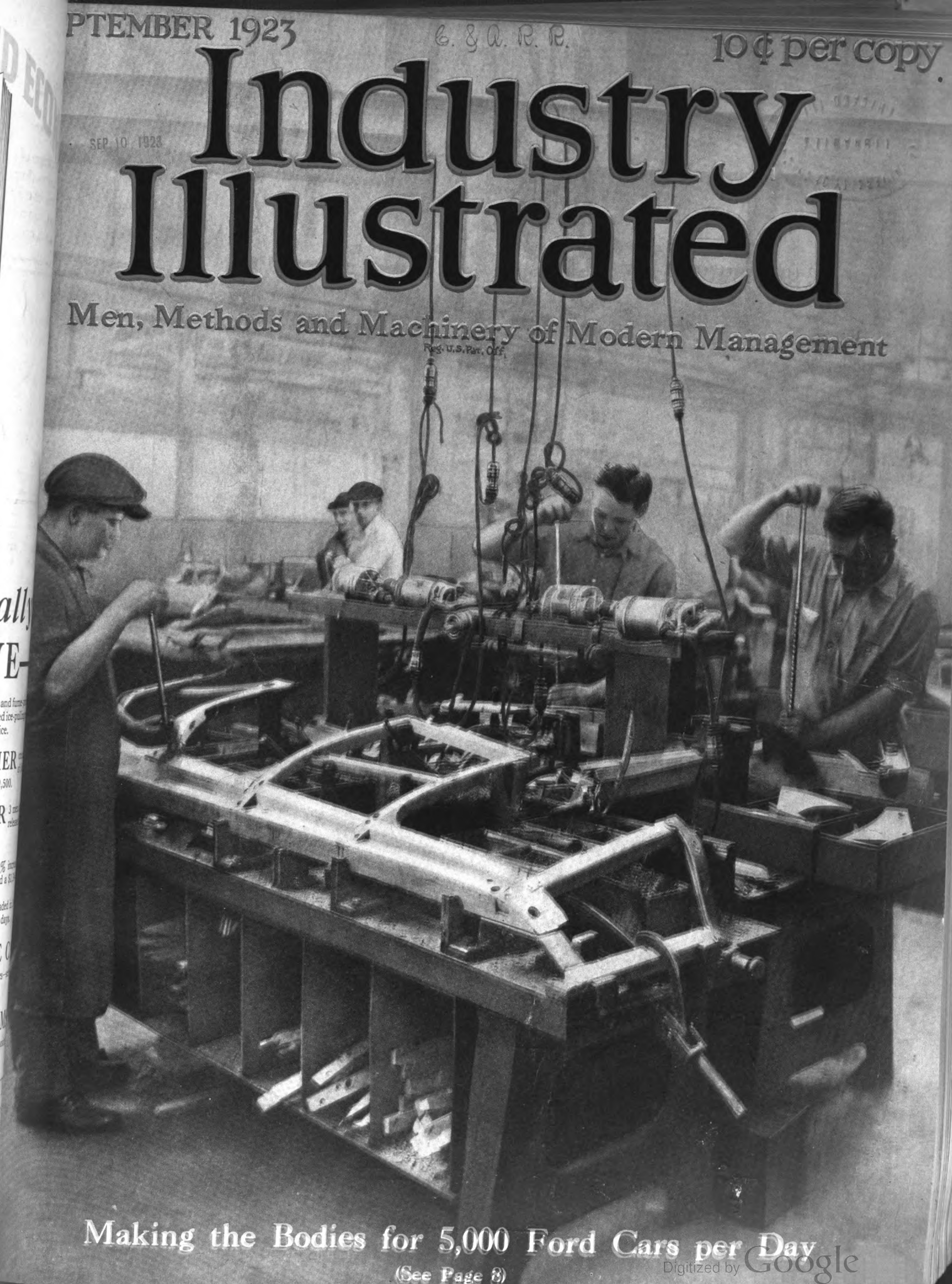
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Industry Illustrated

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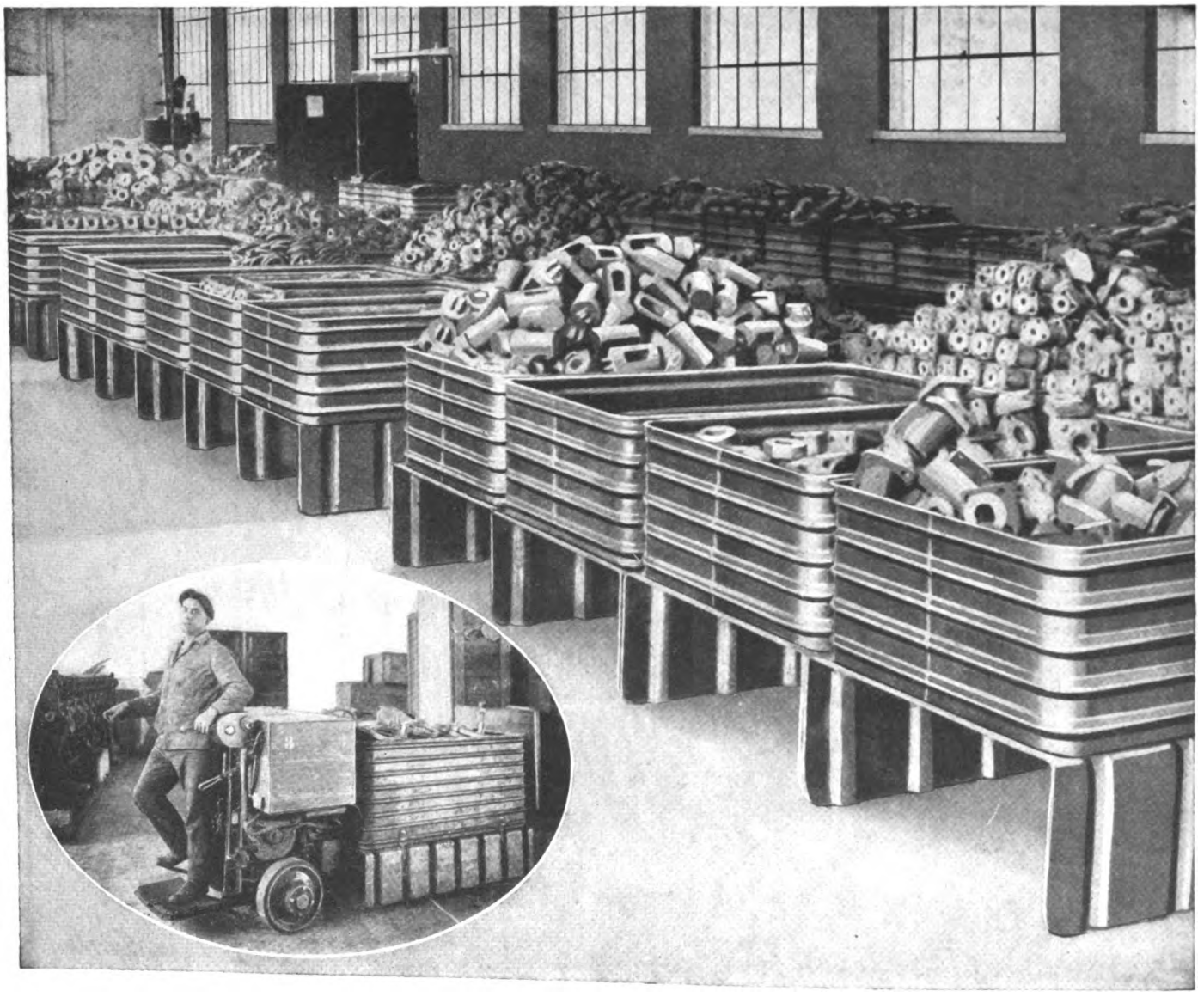


Making the Bodies for 5,000 Ford Cars per Day

(See Page 8)

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Industry Illustrated



Construction Work
on the Hetch Hetchy Dam

We are always glad to supply, on request, information regarding any illustrations which appear in INDUSTRY ILLUSTRATED.

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On page 54 will be found a list of those concerns to whose courtesy we are indebted for photographs in this issue not otherwise credited.

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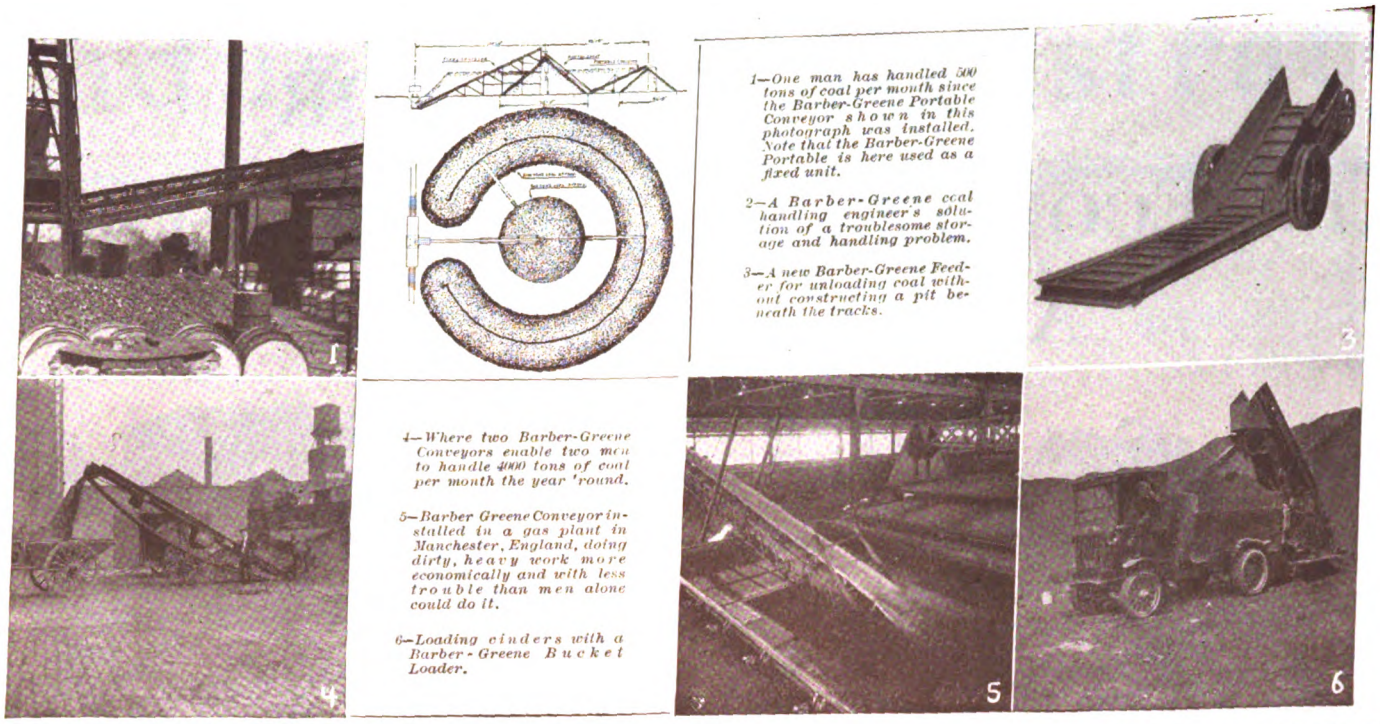
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1—One man has handled 500 tons of coal per month since the Barber-Greene Portable Conveyor shown in this photograph was installed. Note that the Barber-Greene Portable is here used as a fixed unit.

2—A Barber-Greene coal handling engineer's solution of a troublesome storage and handling problem.

3—A new Barber-Greene Feeder for unloading coal without constructing a pit beneath the tracks.

4—Where two Barber-Greene Conveyors enable two men to handle 4000 tons of coal per month the year 'round.

5—Barber Greene Conveyor installed in a gas plant in Manchester, England, doing dirty, heavy work more economically and with less trouble than men alone could do it.

6—Loading cinders with a Barber-Greene Bucket Loader.

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The direct saving shown by Barber-Greene Portable Conveyors and Bucket Loaders is, of course, the strongest factor among many that lead employers to prefer them to shovel gangs. But the tendency of labor to leave the dirtier jobs whenever opportunity offers, and the resulting petty disorganization, have led many companies to install this equipment who otherwise—probably largely from force of habit—would have been blind to the economies it effects. The illustrations and descriptions at the top of this page show a few of the many applications that Barber-Greene coal handling engineers have devised at the request of organizations who wished to minimize the amount of troublesome dirty work in their plants. These engineers have solved a great variety of coal-handling problems and are thoroughly conversant with all standard, and many special, types of coal storage and handling layouts. Their success in solving dirty-work problems with Barber-Greene equipment is due to the thoroughness of their training and experience and also to the superior flexibility and adaptability of Barber-Greene Loaders and Conveyors. Send for additional performance data and our catalog V.

The applications shown here

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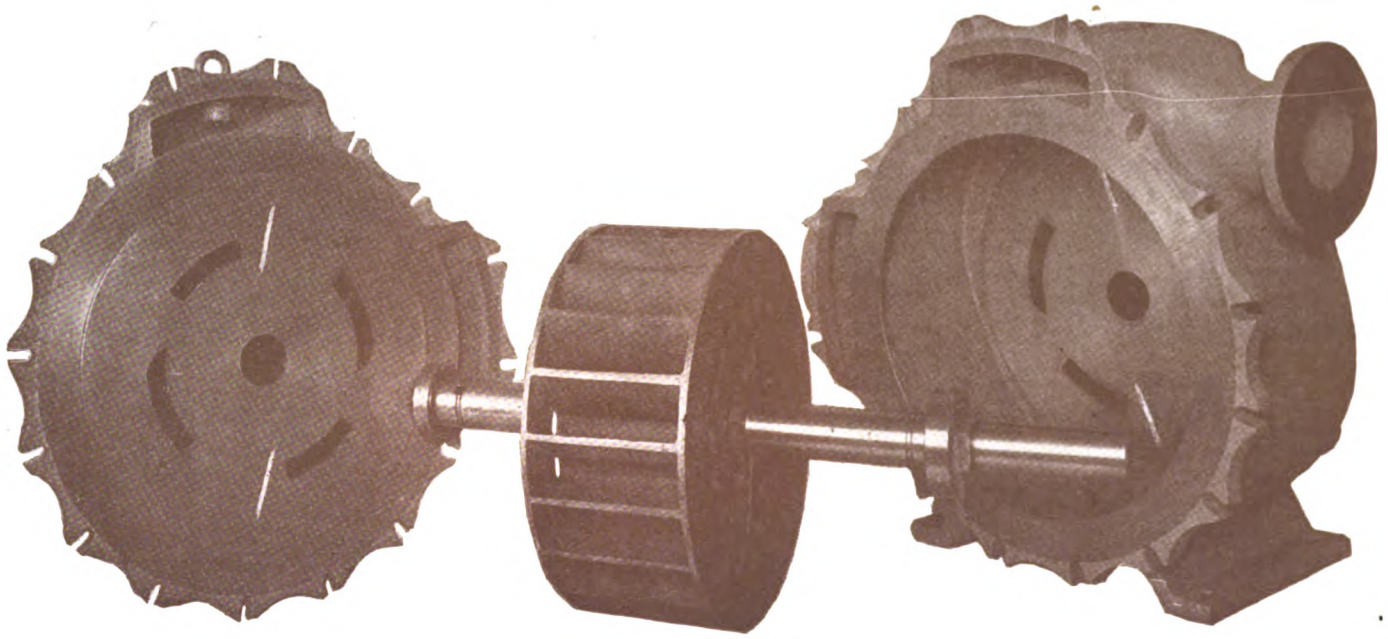
BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

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THE ECONOMICAL AIR COMPRESSOR AND VACUUM PUMP



ALL THE PARTS OF THE HYTOR

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As the peripheral clearance is large, there is no possibility of the ends of the rotor blades coming in contact with the casing.

The original high efficiency is maintained indefinitely in continuous service.

The air is thoroughly washed during compression and contains no oil.

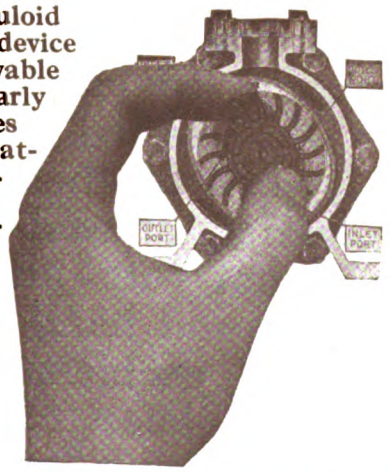
Hytor compressors occupy very much less floor space and are much lighter in weight than reciprocating compressors.

They run without vibration.

The cost of installation is greatly reduced as no expensive foundations are necessary.

No expert attendance is required as there are no adjustments to make. The cost of upkeep is negligible.

Hytor compressors are quiet in operation.

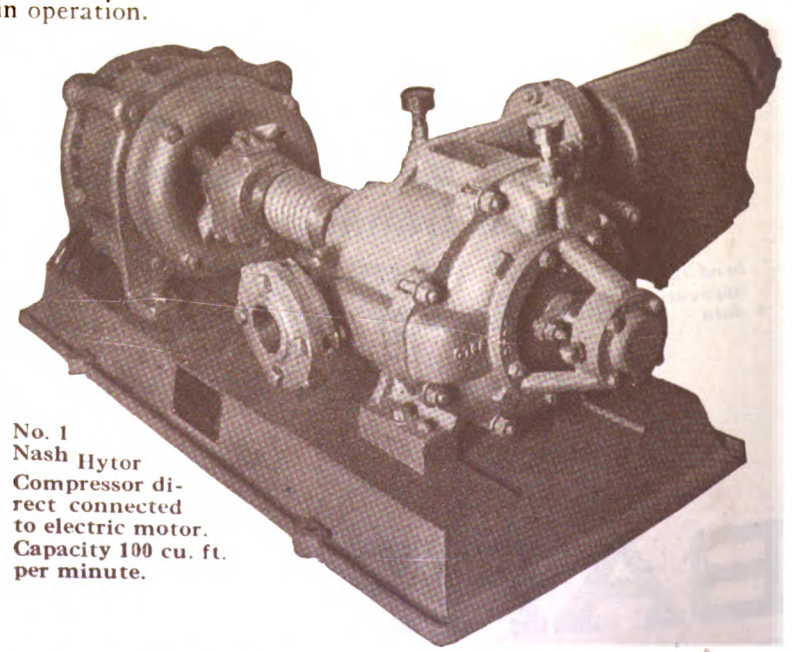


This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.

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Industry Illustrated

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EDITORIAL

What is Coal Worth?

AS this editorial is being written, the nation is faced by the very real threat of a strike in the anthracite coal fields. By the time these words are in the hands of our readers, the threatened strike will either be an actuality, or else some as yet undiscovered ground for compromise will have been reached.

The idea of a coal strike is not new; in fact, it bids fair to become perennial. So far as the general public is concerned, the only tangible result of last year's strike—aside from a modicum of real hardship and a great deal of inconvenience—is that coal prices to the consumer remain higher than the general commodity price level would seem to warrant.

No fair-minded student of industrial history would pretend that all strikes are unjustified. There have been in the past many cases where employer injustice and abuse of power made a strike the only possible recourse. It is none the less true that, broadly speaking, strikes and lockouts are in the same category as war: none of them ever results in an economic gain to any participant commensurate with the cost. If, for example, a man goes on strike for five months, and thereby gains a twenty per cent. wage increase, it will take more than two years at the higher wage to repay him in money for the wages lost while on strike.

The whole vast business of the mining and distribution of our coal is so intricate, so many-sided, so full of glaring inconsistences, and so be-clouded by charges of profiteering, slackerism, lobbying and what-not, that the hundred-and-odd millions of us who are not immediately connected with the industry—but who are vitally affected by its strikes and wage agreements—cannot justly appraise the situation.

Without doubt there are some highly estimable and intelligent gentlemen among the miners, and some equally estimable gentlemen among the operators. It is highly probable that if these individuals could assume control of their respective camps a settlement would be reached in short order, and on a basis of justice to both. At the present writing, however, such a possibility seems remote.

There is one consoling thought which is too seldom dwelt upon; consoling, at least, to that great, voiceless body of ultimate consumers who always pay. And that is the old adage that necessity is the mother of invention. Already, as a result of last year's experience, many anthracite coal consumers have learned to use substitutes—coke, oil, and cheaper grades of bituminous. Moreover, there has been deeper study of the question of preventing heat wastes by proper insulation. Many domestic consumers of anthracite coal have found that attention to this neglected detail resulted in making seven tons of coal do the work formerly requiring ten tons. And the high cost of coal has also helped to stimulate interest in the development of water power resources.

If the long-drawn-out and just celebrated coal controversy lasts for any great length of time, the participants may some day awaken to the realization of an age-old truth: That any commodity, once its cost passes the bounds of reason, becomes unmarketable.

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Making Bodies for Ford Cars

First Pictorial Description of an Amazing Industry

BY JOHN H. VAN DEVENTER

ALL of the body parts for the entire American output of Ford cars, with the exception of the coupe, are fabricated in the B building at River Rouge. In itself, this body work constitutes an industry employing over 6,000 men, in spite of the fact that comparatively few bodies are completely assembled in Detroit. For the Ford policy is to decentralize body assembly, to ship carload sets of "knocked down" body parts to the various assembling plants located throughout the United States. In these branch plants the bodies are assembled, painted and fitted to the chassis.

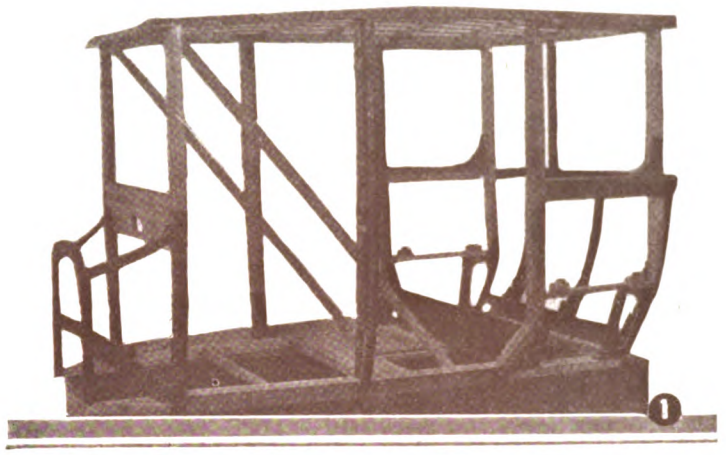
A system of this sort is made possible only through the evolution of a highly standardized body design, particularly adapted for quick and simple final assembly.

What one finds in the body plant at River Rouge today is a carefully specialized and highly integrated process of manufacture whereby sheet steel and hard wood are transformed with almost confusing celerity into "knocked down" body parts.

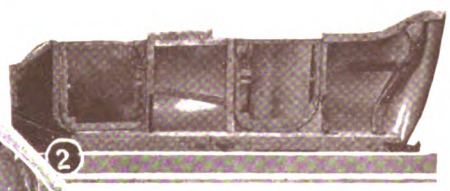
Roughly speaking, and for purposes of description, the process of body part making divides itself into four parts:

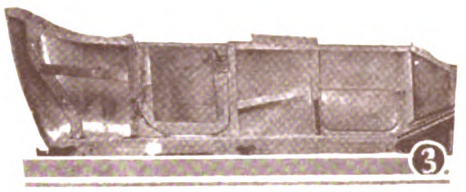
1. Sheet metal stamping and forming.
2. Wood part sawing and fabricating.
3. Framing, paneling, door hanging and fitting.
4. Shipping.

The sheet metal operations occupy possibly 25 per cent. of the total floor area devoted to body work. The heavy presses are located on the ground floor under the mezzanine on the eastern side of the northern half of the B building. The lighter presses for small sheet metal parts are located on the mezzanine immediately above. The sheet metal arrives in cars near the eastern wall of the building. From temporary sheet storage piles just inside this wall the work flows from east to west through various progressive "line ups" of presses, emerging at the cen-



Figs. 1, 2 and 3. Above is the wooden skeleton of a Ford four-door sedan before the metal panels are applied. Below are the right and left-hand sides of the touring car body.





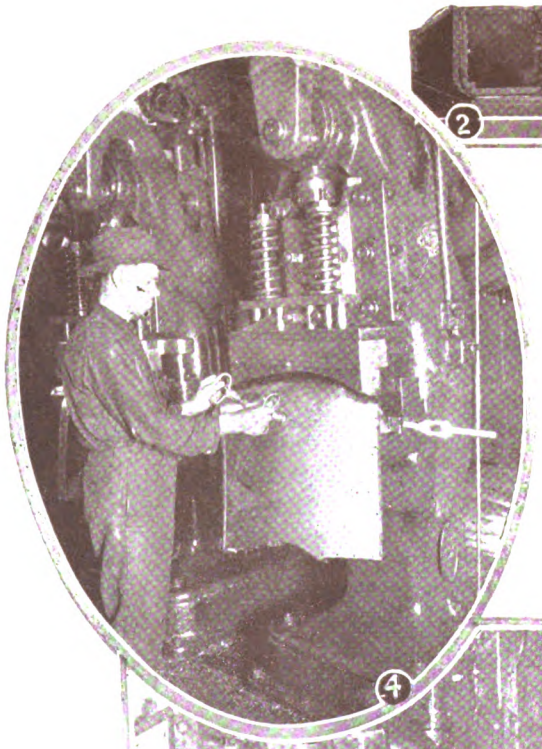


Fig. 4. Safety in handling sheet metal work in the presses is a first consideration. The picture on the left indicates this.

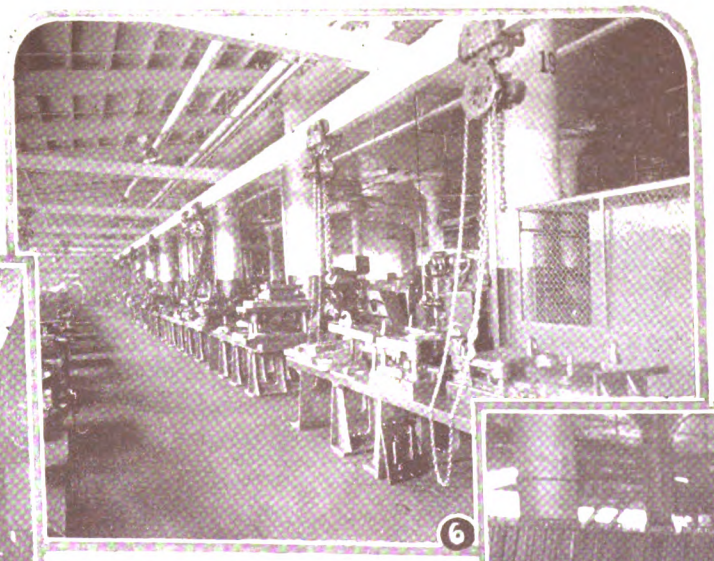


Fig. 6. To keep the complicated dies in proper condition a large tool repair and maintenance department is required. One view of this is shown above.

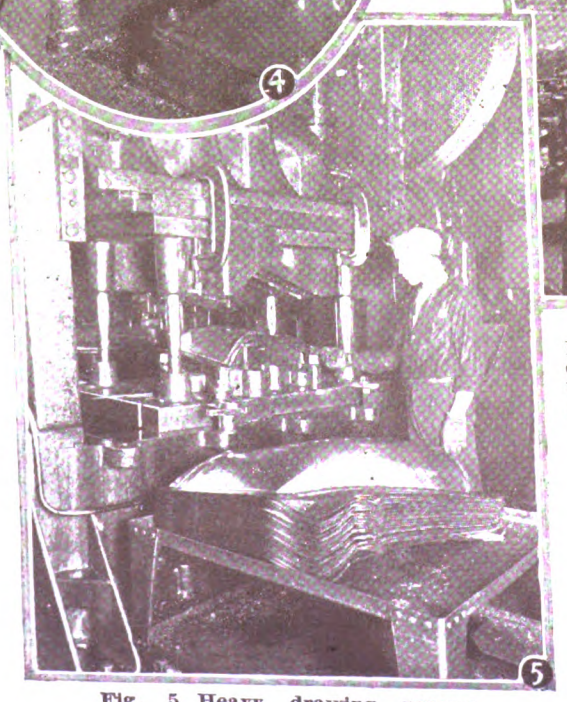


Fig. 5. Heavy drawing presses form the curves in the body panels.

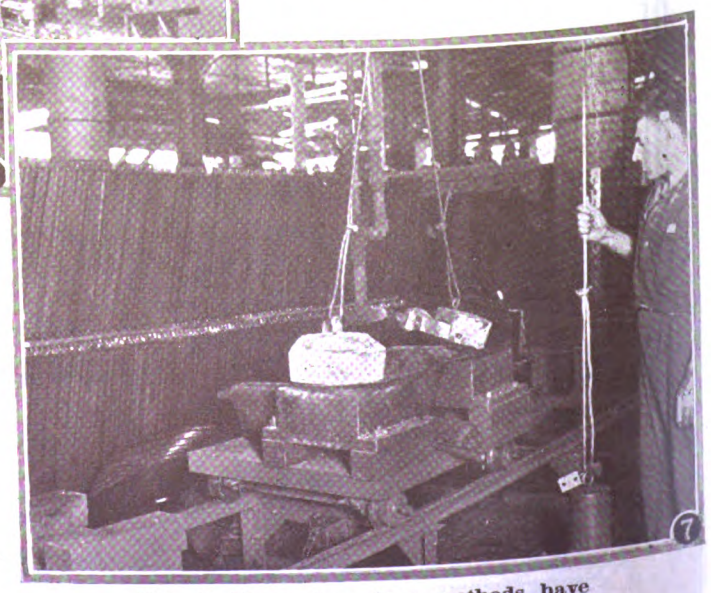


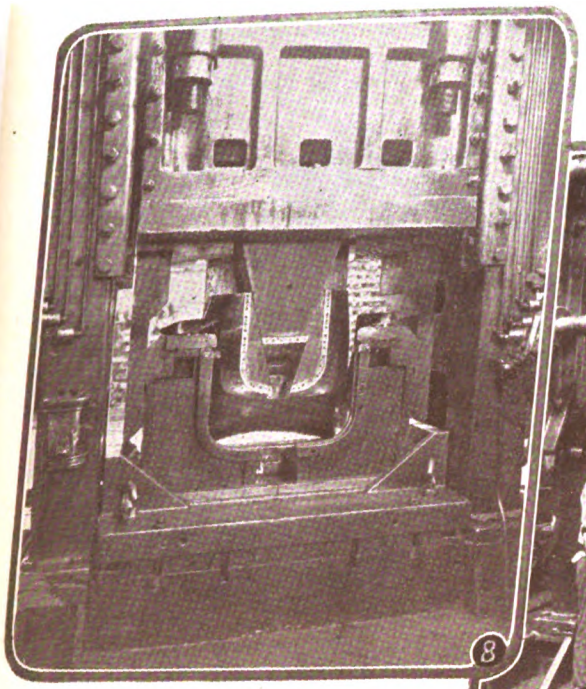
Fig. 7. Many ingenious methods have been worked out to aid sheet metal production. Here, for example, cowl corners are being heated before dinging.

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Cars

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Figs. 8 and 9—Above and at the right are shown two views of the huge drawing press which forms the sedan cowl in one piece.



tral bay in finished form. Here such parts as are now complete without the addition of woodwork are made directly into sets for shipment to the branch assembling plants. Panels and other parts requiring framing are lifted by crane to the assembling mezzanine on the west side of the building.

Hardwoods arrive in various forms, kinds and sizes, both in logs and rough sawn. After kiln drying, this stock proceeds to the gang saws that are located on the ground floor under the west mezzanine at the northern extremity of the plant. Operations on the sedan woodwork progress from north to south on the ground floor level. Operations on the touring car body wood parts take place on the western mezzanine immediately above and

Fig. 10. Below is a view in the central bay in the body plant showing cars ready to be loaded.



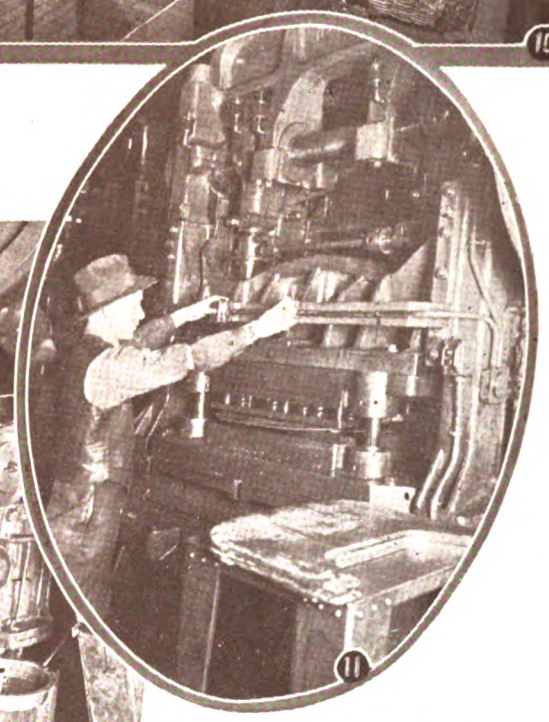


Fig. 11. Safety buttons are provided on each press so that the stroke cannot be commenced while the operator's hands are in danger.

Fig. 12. Here is the final operation on the all-metal cowl, namely, stitching on the bracket for the radiator tension rod.

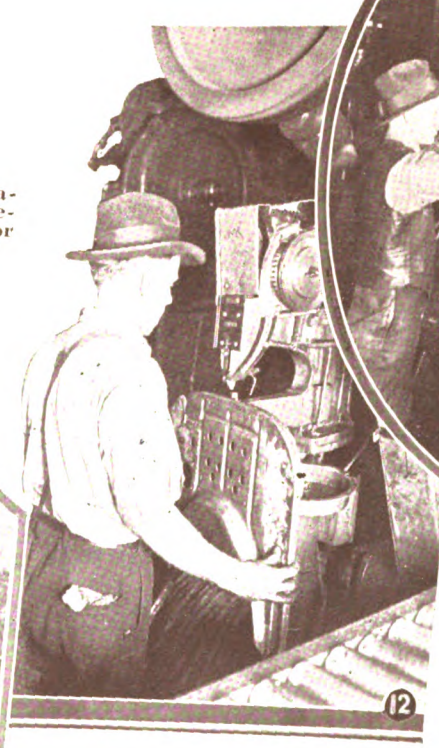




Fig. 13. Here is shown an operator putting a stamping into one of the big presses. Note how his hands are kept from between the dies.

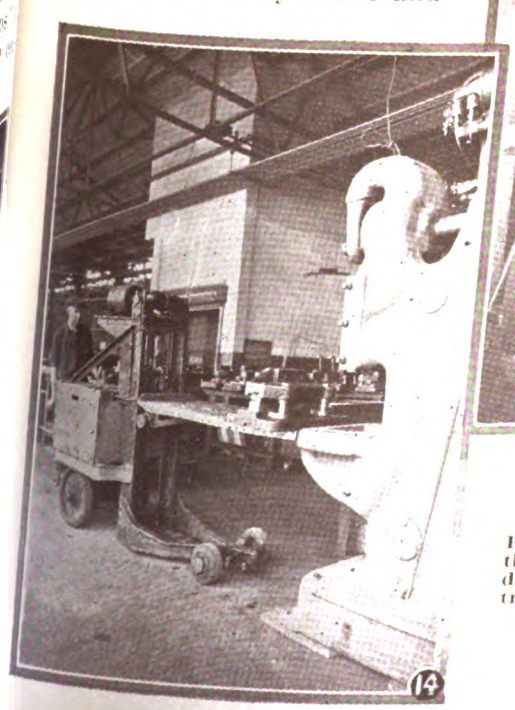
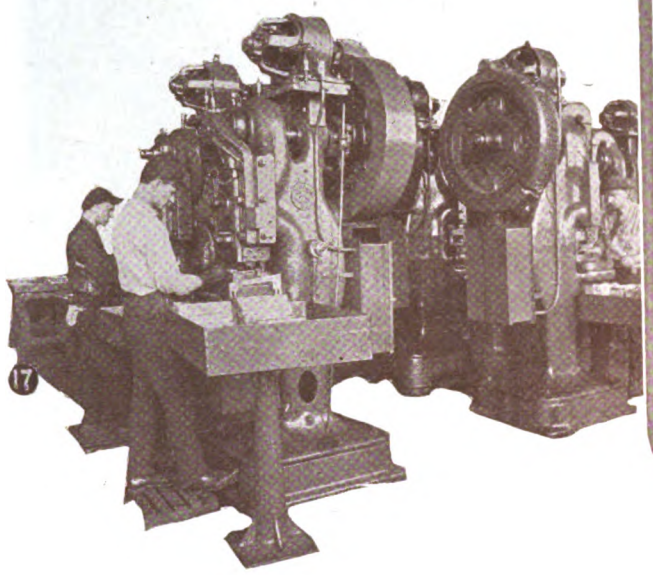


Fig. 14. At the left is shown the method used in transporting dies at River Rouge, the lift truck elevating them to the level of the press platen.

also progress in the same direction. The framing and paneling of partial assemblies for "tour car" parts are done on this same mezzanine, the progression also being from north to south. Completed assemblies are brought by conveyor and otherwise down to the ground floor level to the center bay which at present is the car loading station. Plans are being now made to completely conveyorize this transportation. This will include the installation of finished stock conveyors running to car loading platforms outside of the building, doing away with the necessity of employing valuable crane-served floor space for car loading and thus permit

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Fig. 17. Below is a view of the hinge press line-up. Each touring car requires six hinges.



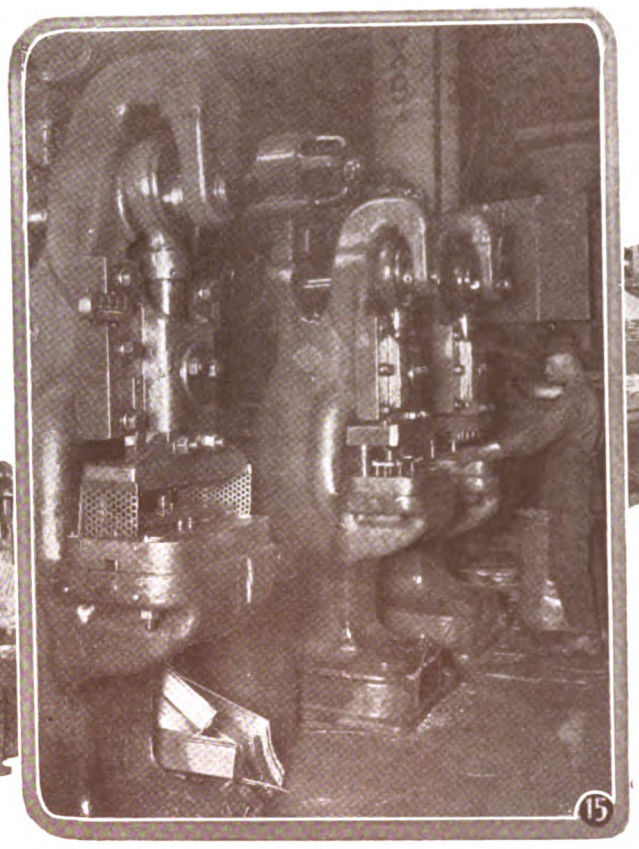


Fig. 15. One of the battery of waste utilization presses which is arranged alongside of each principal production line-up. Here scrap is worked up into usable parts.



Fig. 16. This shows the making and assembly of touring car door hinges.

ting this area to be used for heavy press work.

Along this eastern inside wall of the building are the temporary sheet metal storage piles which feed the various batteries of "line-ups" of presses which fabricate the sheet metal parts and which are arranged in distinct progressive groups running from east to west. Production on these presses is balanced so that there is practically no inter-operation storage or piling. There may, of course, be a few pieces ahead of each operator but strictly speaking they work from hand to hand, operations being so timed that it is a case of out of one press and into another without delay. Under such a system while the individual efficiency of one or two machines may suffer and their maximum output not be ob-



Fig. 19. After the scrap is baled it is raised on an elevating conveyor and dumped into box cars which take it to the foundry.

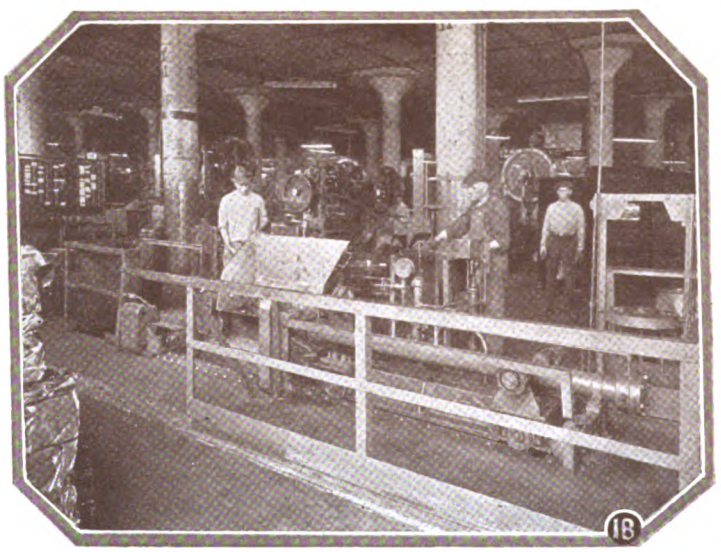


Fig. 18. Above is one of the scrap baling presses where sheet metal which otherwise cannot be utilized is pressed into compact bales for remelting.

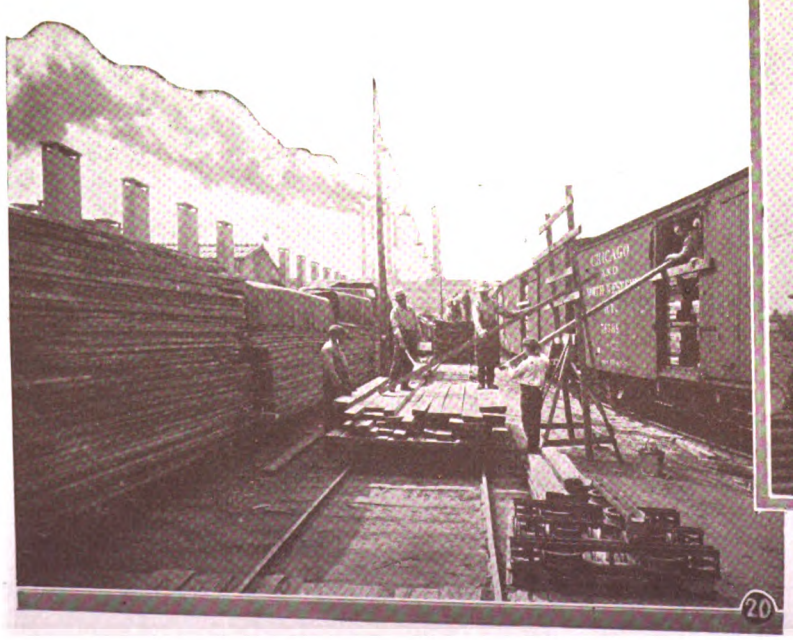


Fig. 20. At the left is a typical view in the lumber storage yard with cars being unloaded and graded.



Fig. 21. A saw mill is located at the plant although the larger portion of the lumber used comes in rough sawn boards.

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hows the making
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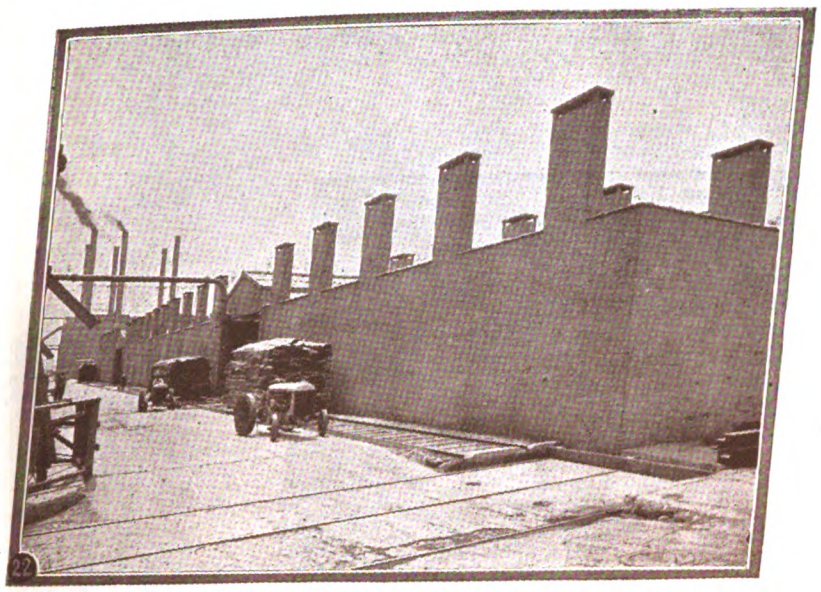


Fig. 22. Above is a view of the dry kiln through which goes the lumber to be used in Ford body production.

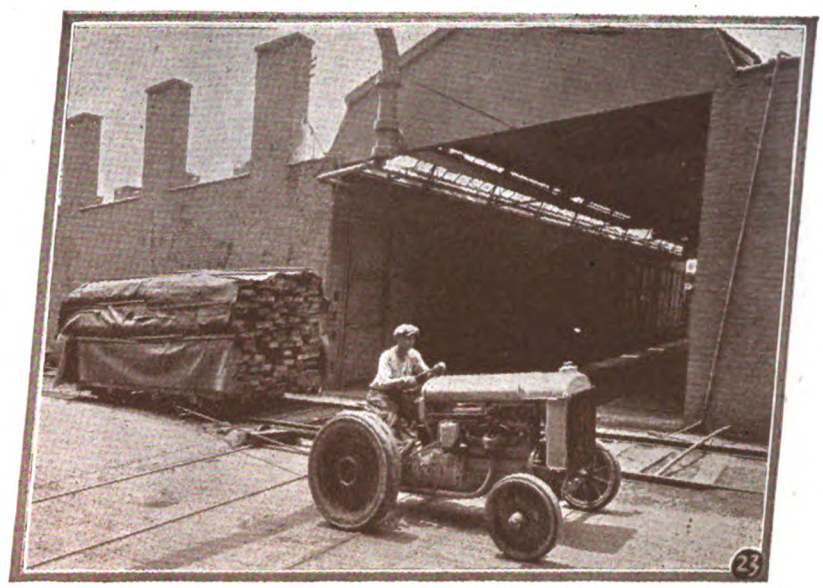


Fig. 23. Ford tractors are used to draw racks of lumber from the dry kiln to the body plant.



Fig. 24. An impressive array of dust collectors indicate the extensive amount of saw dust produced from woodworking operations.

tained, nevertheless, the efficiency of the group which represents the total efficiency or over-all efficiency of making the part is a maximum. In most of these groups the presses are located in such manner that the press operators pass the parts from one to the other, either from hand to hand or by sliding on gravity conveyors or slippery slides Thus in the majority of "line-ups," from the time that the sheet leaves the storage pile to the time that the last operation has been completed there is no necessity for the employment of roustabouts or material handlers.

The Ford idea is to "make something" out of every bit of scrap or waste whether this be wood or sheet iron; therefore the scrap coming from the trimming of presses and blanking presses has been carefully studied to determine what Ford or Fordson parts can be stamped from it. Once this

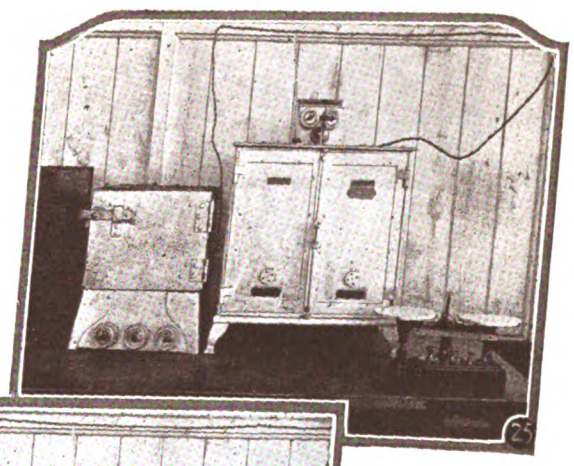
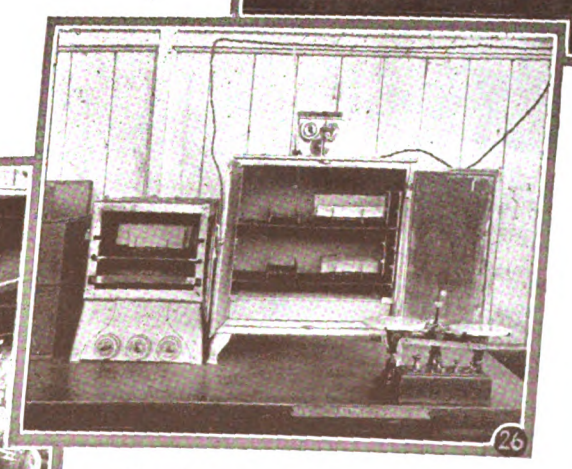


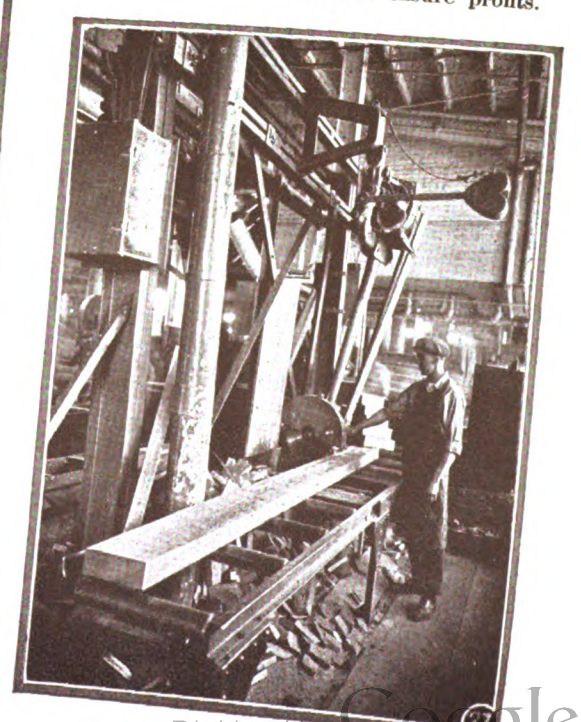
Fig. 27. Below is the start of the fabrication of body and wood parts. The cut-off saws must be used with discrimination and judgment to insure profits.



Figs. 25 and 26. Above are two views of the electric baking oven used for drying samples of lumber to determine its moisture contents by weighing the samples both wet and dry.



Fig. 28. A literal forest of wood parts is shown above; yet it is but a fraction of a day's requirements.



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Fig. 29. For making wide boards out of narrow ones the ingenious machine pictured above serves a useful purpose. It is called a Linderman.

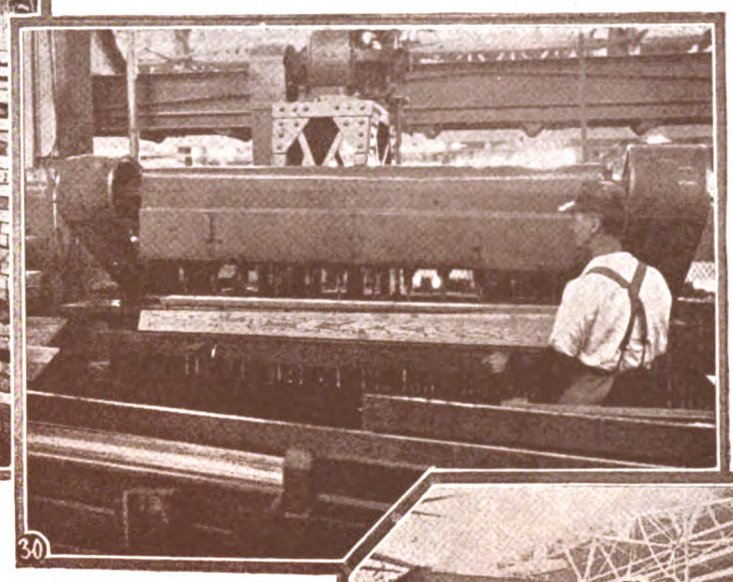


Fig. 30. One of the operations on a touring car sill is shown here. Twelve holes are bored at one time.



Fig. 31. This machine is known as a bull planer and puts the beveled surface on the side of the rail.

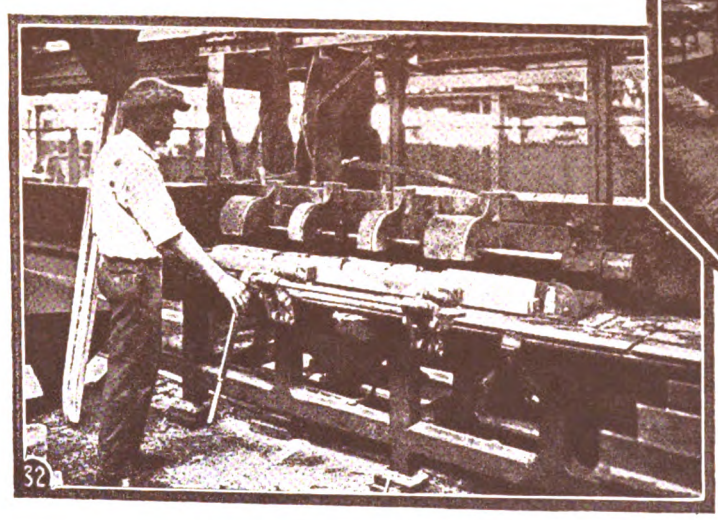


Fig. 32. At the right is shown a machine which quotes gains or cuts slots in the sill frame.

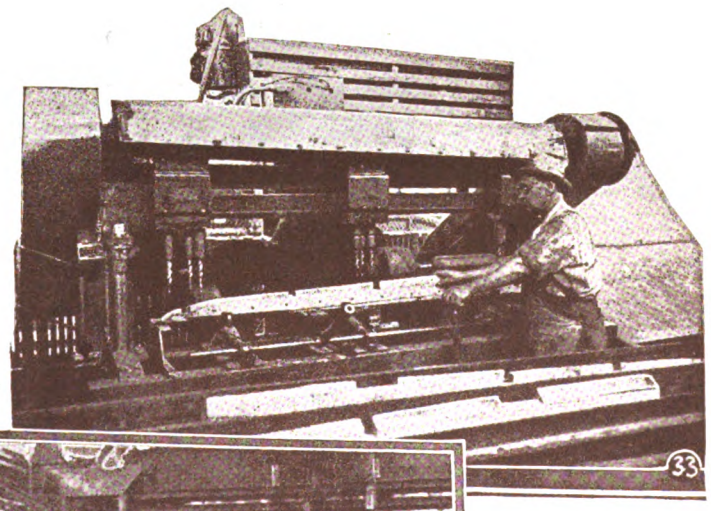


Fig. 33. Another operation on the sill frame is to bore for body bolts, as shown above.

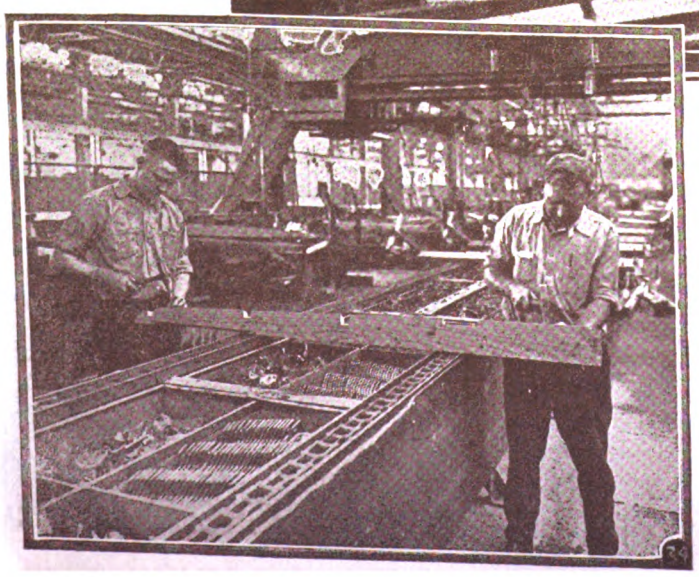


Fig. 34. At the left is the first operation in the assembly of the wooden tour car frame, namely, with driving of the body bracket bolts.

has been decided, a *waste utilization group* of presses is included in the unit or little factory. Thus this waste is worked up immediately and with the least amount of transportation into usable parts, reducing to a minimum the amount of steel scrap to be baled and remelted.

Unredeemable scrap goes to the baling room. After a bale is made and is elevated by the vertical plunger of the press it is kicked by the quick action of the horizontal ram into an inclined chute. This leads it to the underground leg of an elevating conveyor which in turn carries it up through the side wall of the building, and drops it into an open gondola car. Train loads of this scrap are pulled to the foundry where the contents are hoisted to the back stock gallery. Some three and a half car loads of this scrap is baled every day. When compared with the consumption of fifty carloads of sheet steel per day, this gives an approximate net loss, as far as the sheet metal department is concerned, of seven per cent. Inasmuch, however, as all of

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Fig. 30. One of operations on a ing car sill is here. Twelve are bored at



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Fig. 35. At the right is shown one of the metal paneling benches where the sheet metal panel is attached to the wooden body frame.





Fig. 36. Left and right hand paneling require different procedure, since there is a blind door on the driver's side.

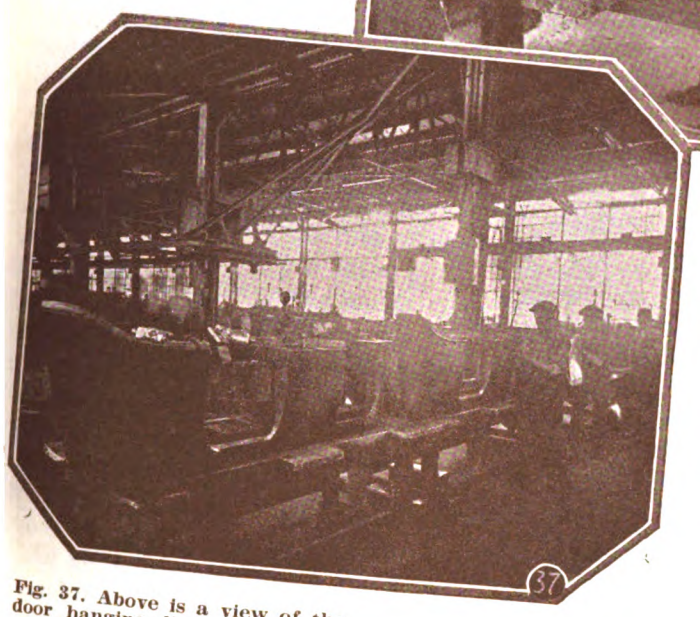


Fig. 37. Above is a view of the door hanging line where the touring car doors are fitted.

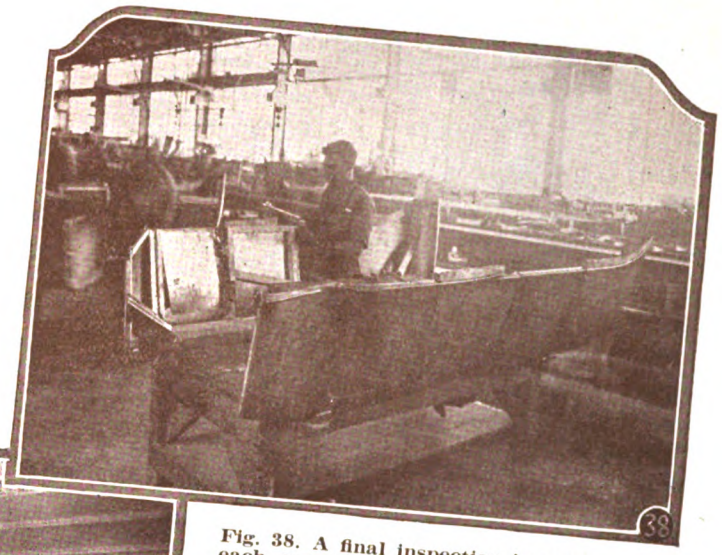


Fig. 38. A final inspection is given each complete side panel with its doors attached to see that everything is in good condition.

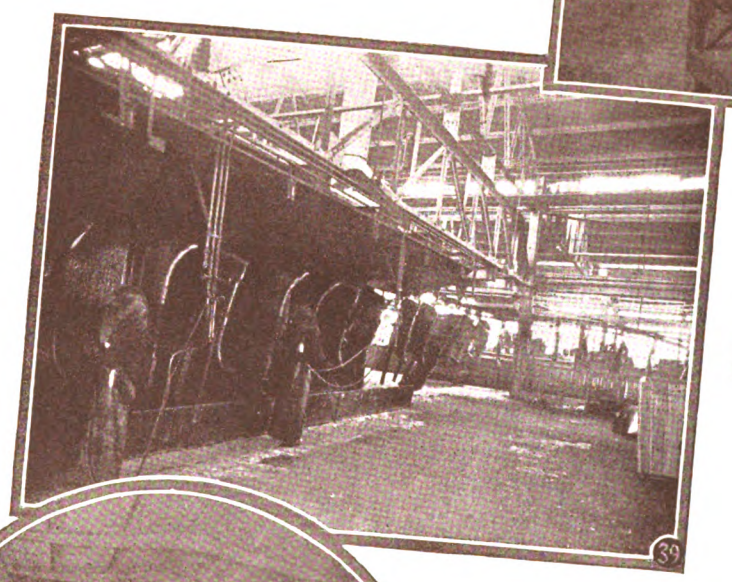


Fig. 39. At the left is a view of the paint spraying station. The side panels pass slowly, carried by the overhead travelling conveyor.

this goes back into the cupola and thus into cast iron products, there is very little loss as far as the plant as a whole is concerned except that which is occasioned by remelting.

The raw material, *wood*, comes into this plant in various kinds, forms and sizes. A considerable portion of it is already coming from the Ford holdings at Iron Mountain and elsewhere. That received as logs is sawn into boards in a saw mill northwest of the B building, a mill having a capacity of approximately 50,000 board feet per day, power for operating which is provided through burning the bark and trash. Ultimately all of the sawing of Ford logs will be done in the forests in local mills where in fact it is intended to save considerable freight by also finishing completely many of the wood body parts.

It is truly said that the operation of the saws can make or break any woodworking plant. Boards and planks do not partake of the uniformity of dimension of other raw materials, such as steel sheets,

(Continued on page 56)

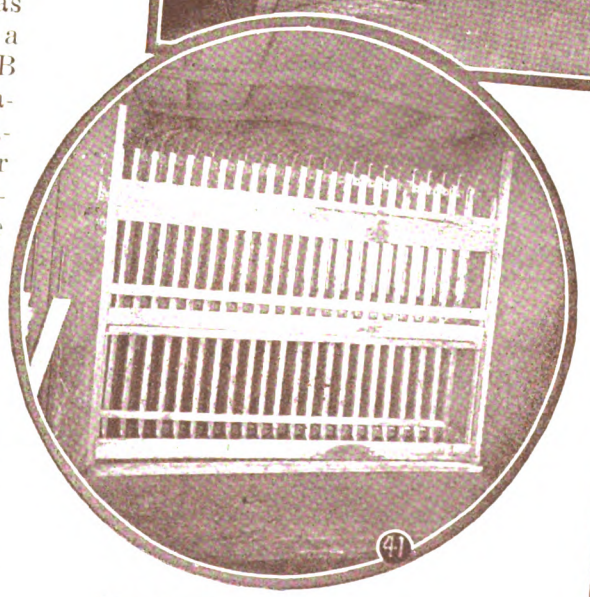
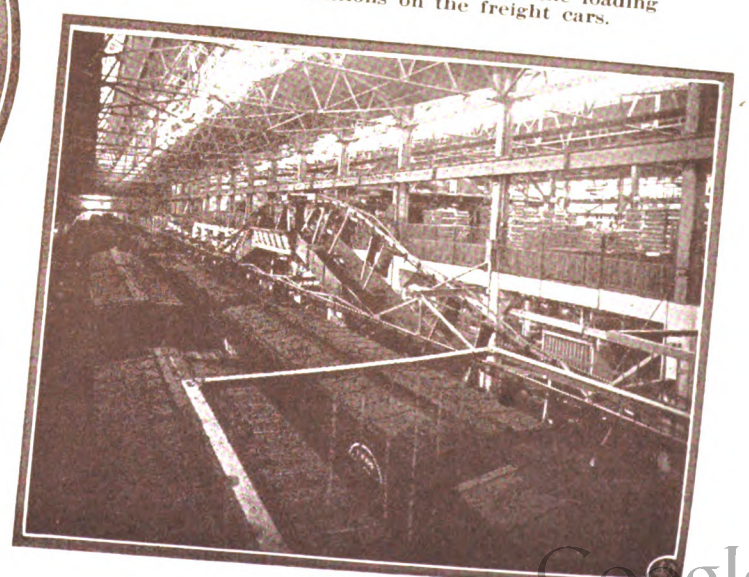


Fig. 41. Car loading has been reduced to a science as indicated above; which shows the method of stacking side assemblies in a box car.

Fig. 40. After leaving the paint sprayer the side panels descend as shown below and pass the loading stations on the freight cars.



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Industrial Americanization that Pays

BY FRED H. RINDGE, JR.





Memorial Day exercises at a plant where many races and nationalities are represented. This is but one phase of the work of Americanization.



Above — The plant library is a thing all too seldom encountered; offering, as it does, a splendid means of education and stimulation toward improvement.

Above—Outdoor sport, the great leveller of race, creed and class; which here, as in Engand, has been a vital factor in the making of a good citizenry.

"WHEREAS the United States is at peace with all nations and Whereas it should be the duty, desire and aim of all loyal citizens to strive for real equality among all, regardless of descent, color or religion, be it resolved that we protest against the use of any expression intended to ridicule or belittle any one because of his birth, descent, color or religion, in public speeches, the press, moving pictures or on the stage. In this connection we protest against the use of such terms of abuse as 'Chink', 'Chippey', 'Coon', 'Dago,' 'Dutchman,' 'Frog-eater,' 'Guinea,' 'Greaser,' 'Harp,' 'Heinie,' 'Kike,' 'Limey,' 'Mik,' 'Nigger,' 'Sparrow,' 'Sheeney,' 'Wop,' and similar expressions which tend to arouse dissatisfaction and ill will towards the United States, in the individuals and classes who are thereby made ridiculous."

Thus one of thousands of foreign societies in America expresses itself on a problem thoroughly familiar to industrial leaders. Every fair-minded manager and foreman will



At the right—An Americanization Secretary of the Y. M. C. A. talking to a prospect for naturalization, and explaining matters in a sympathetic way.

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A typical class of Mexican peons, at El Paso, Texas, being instructed in English, and in American ideals and ways.



A shop meeting in a large plant, held under the auspices of the Y. M. C. A. This kind of work, begun during the war, should not be allowed to lapse.

gree that the sooner such erms are eliminated from usiness and industry the ooner we will have mutual unerstanding and increased efiency.

The census of 1920 showed nat there were in the U. S. 3,712,754 immigrants and 22,-86,204 persons of foreign parntage. The "foreign white tock" of the nation's populaion showed an increase of 4,-55,576 or 12.9 per cent over he volume of "foreign white tock" in 1910. Now, approximately one-third of the total opulation of the United States is either foreign, or enirely or partly of immigrant lescent. The term "alien" is ot the correct characterizaion of any person of foreign irth coming to this country to ettle. The true natives were he Indians and all who came here were aliens. It has, however, been recognized that since America was an undeveloped country, whose native population was small and insignificant, all the new settlers from various lands united in transforming it into a habitable nation and giving it a stabilized form of government.

Our foreign people comprise thirty-five races, speak fifty-four different languages, read over eleven hundred foreign newspapers published in the United States and form the bulk of many of our most important industries. One-fourth of all the children in America are in foreign homes and over 2,000,000 white women over twenty-one are as yet unnaturalized. In 1913 we received 1,218,000 immigrants while in the fiscal year ending June 30, 1922, the number was only 309,000, largely women and children. Over 300,000 have already arrived during the present fiscal year. No one will deny that we have a great problem, which centers largely in industrial operations and communities. *The responsibility for its solution, therefore, rests to a large extent upon industry.*

Over 4,000,000 Italians live in America and read more than 300 Italian papers. About as many Poles reside here and have over one hundred newspapers with a combined circulation of at least 1,500,000 copies. There are more than 400,000 Greeks, as many Russians, 1,000,000 Czecho-Slo-

(*Continued on page 62*)

Below—Noon-hour plant band concert; a get-together feature of great value.



Below—The first requisite, of course, is to learn the language.



Below—Thirty-six nations are represented in the pageant given by these workers.



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Plugging the Power Leaks

How to Combat High Power-Costs by Stopping the Preventable Losses

By James T. Beard, 2nd

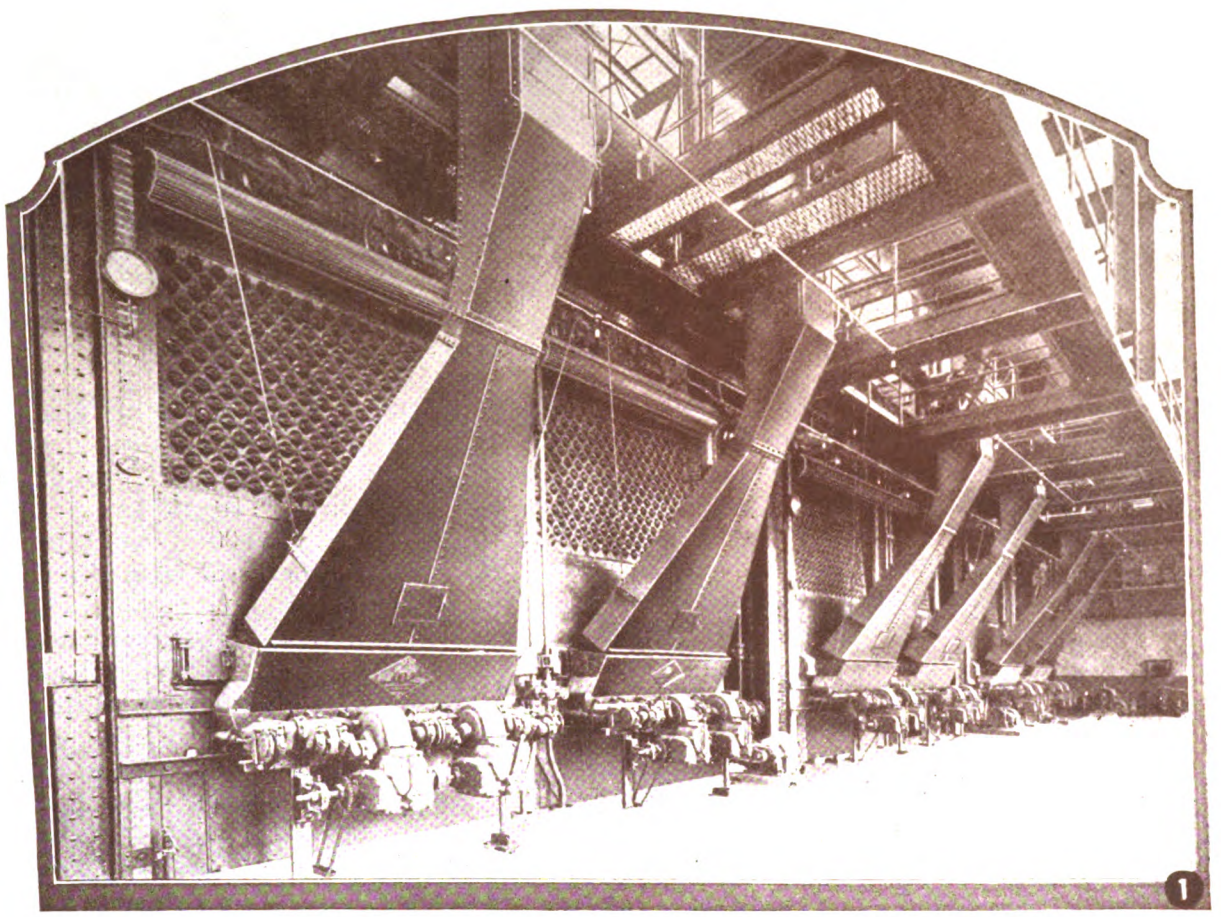


Fig. 1. Multiple-retort underfeed stokers eliminate many preventable boiler room losses because of the continuous feed, even distribution of fuel and perfect control of air supply, which makes them an essential factor in the operation of many industrial power plants.

ECONOMIES in the generation and use of steam power cannot be effected by guesswork; nor is there anything magic or mysterious about them. They are the result of the continuous and persistent application of the few common-sense principles involved, backed by an intelligent understanding of those principles and an accurate knowledge of the operating conditions existing in the plant.

Broadly speaking, the problem of steam power in industrial plants presents three distinct phases, *i. e.*, production, distribution and use. In the generation of steam in the boiler house many losses occur from the time the coal is delivered to the bunkers or the firing floor until the steam itself leaves the drums of the boilers. Some of these losses are entirely preventable; most of them partially.

In a previous article the loss of sensible heat in the stack gases and the loss of unburned coal in the ash refuse were thoroughly discussed. These losses will not be considered here, except to say that they are perhaps the most important boiler house losses, although they are readily reduced by the proper methods.

But there are other losses in the generation of steam which

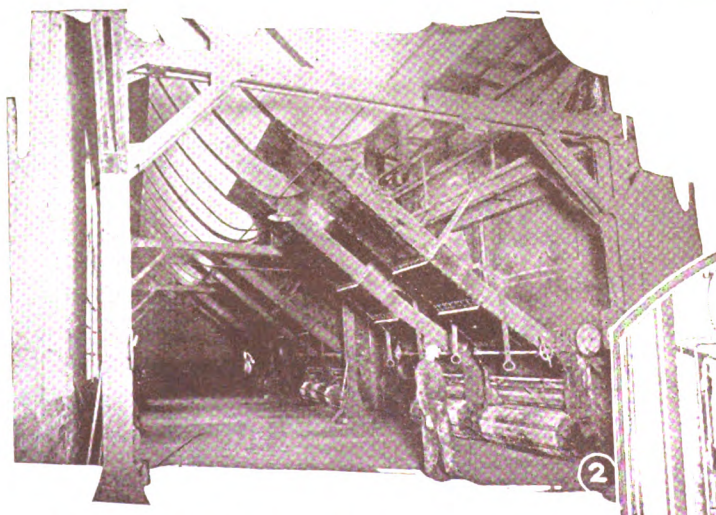


Fig. 2. What the underfeed stoker means to the plant using soft coal, the chain grate stoker means to a plant using lower grades of fuel. Many times large operating economies are made possible by the installation of these stokers and changing from a relatively high grade expensive coal to a cheaper and otherwise worthless fuel.

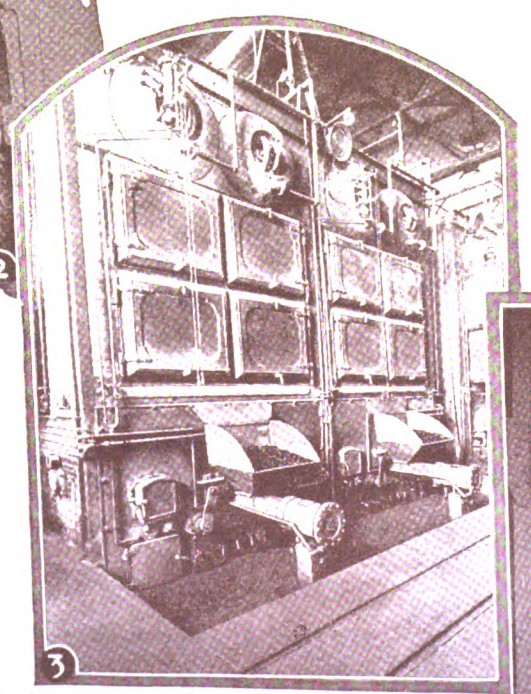


Fig. 3. What is known as a lateral-retort type of underfeed stoker has many desirable points of advantage in the operation of modern boiler plants. High capacity for a sustained period of time is possible with greater economy than hand firing.

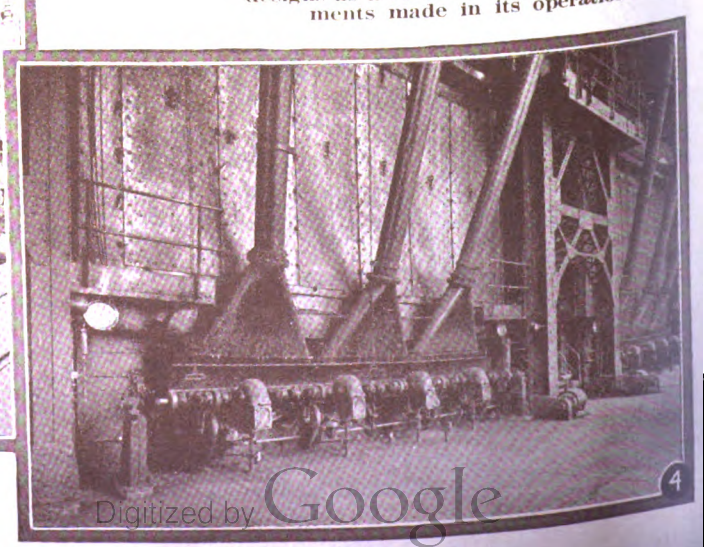


Fig. 4. Another installation of multiple-retort stokers. In recent years this type of equipment has developed into different designs as a result of the many improvements made in its operation.

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respond with equal readiness to the proper treatment. In many cases the heat radiated by the boiler and setting is excessive and represents a considerable waste of fuel. In some plants it is practically impossible to work for any length of time above the boilers, due to this radiated heat. Besides being an actual detriment, as far as working conditions are concerned, these abnormal temperatures represent a dead loss.

Although it is not possible to eliminate this loss entirely, it can be greatly reduced by proper insulation of the exposed drum surfaces and the setting, thus permitting the boiler to do its work as a boiler and not as a radiator.

The selection of the proper grade of fuel that will be best suited to the conditions of the plant is another problem for consideration. Sometimes a cheaper grade of fuel can be burned with greater economy. On the other hand, the writer has seen instances where a more expensive coal, on a tonnage basis, was actually cheaper from the standpoint of economical operation and showed tangible reduction in power costs on the books. The best fuel for the plant is usually discovered only after thorough tests over a reasonable period of time, but the savings effected are well worth the effort involved.

Proper methods of handling

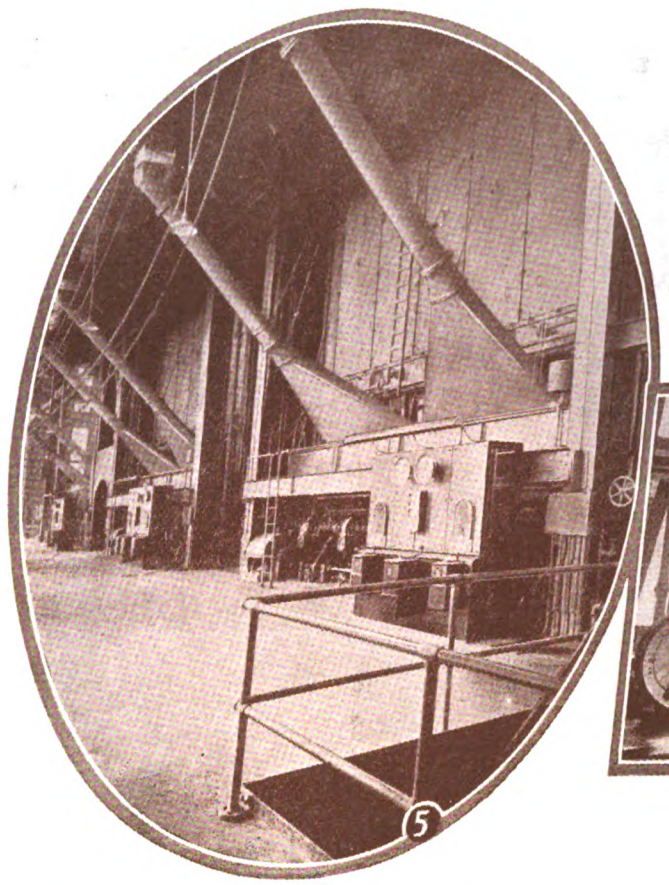


Fig. 5. With proper instruments and means for control mounted upon individual instrument boards, convenient to each stoker, uniform load distribution and high operating economy are possible because furnace and combustion conditions are instantly visible from the firing floor.

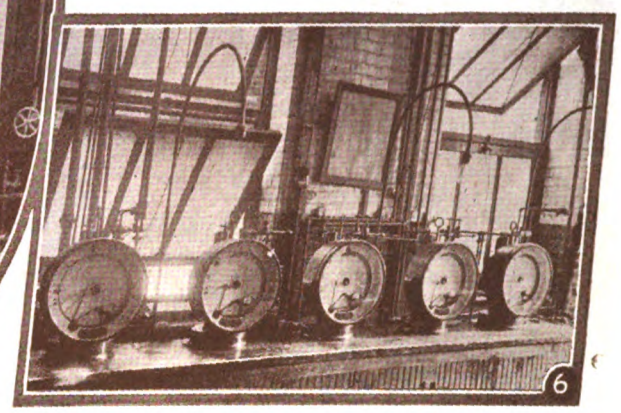


Fig. 6. A set of steam flow meters for indicating the quantity of steam generated by the boilers. This installation is located in a five-boiler plant and provides an individual check on each boiler. These instruments are often located on the boiler fronts, but the picture here shows them mounted in a clean place convenient to the chief engineer's office and readily accessible for adjustment when necessary.

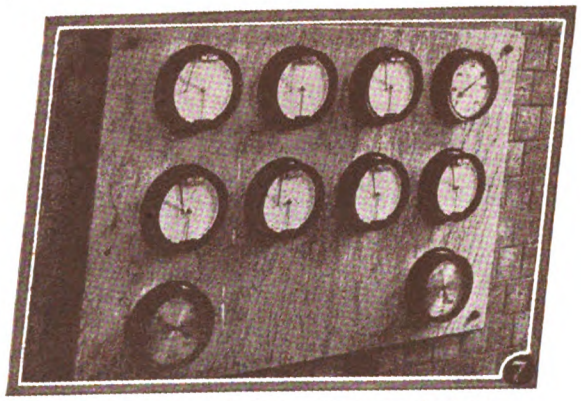


Fig. 7. Sometimes it is more convenient to locate boiler room instruments in the turbine or engine room. This is done in those plants where they will not get proper care in the boiler house. These instruments include recording pressure gages, thermometers for steam, feed water and flue gas, as well as indicating pressure gages. They are always visible to the watch engineer.

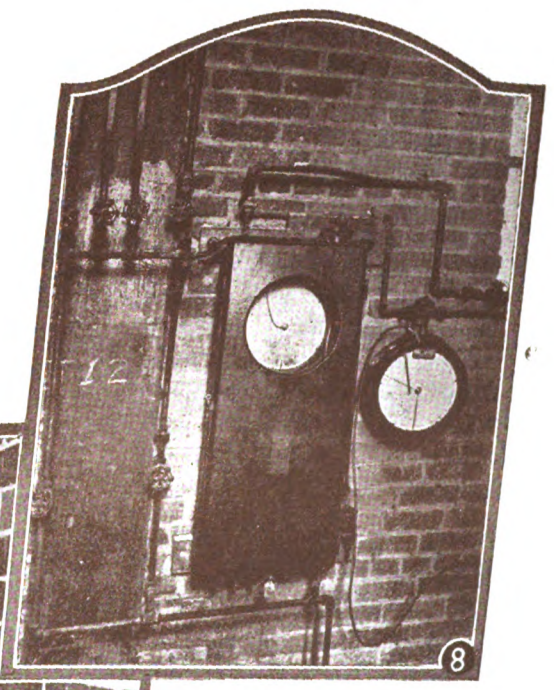
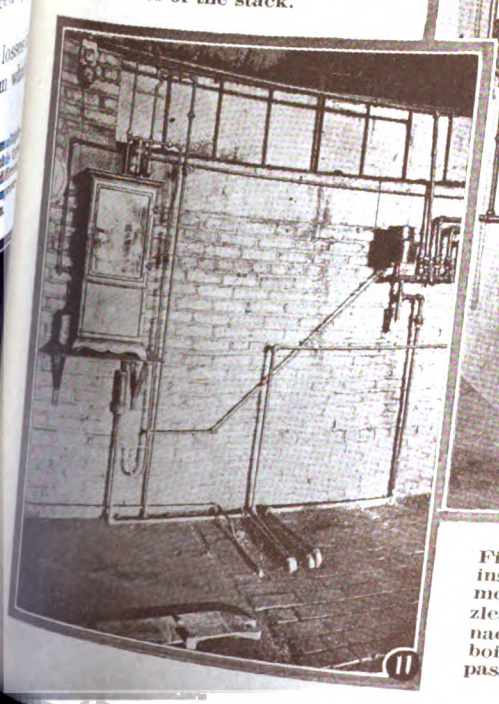


Fig. 8. It is usually practical to mount the recording flue gas thermometer near the CO_2 recorder. Thus an indication of the flue gas loss is always visible and control of this loss is at all times possible.

Fig. 11. Another type of CO_2 recorded. In this case one instrument is connected with three boilers, as well as with the stack. By suitable arrangement of valves and piping, a continuous record may be obtained of the performance of any one boiler or of the stack.



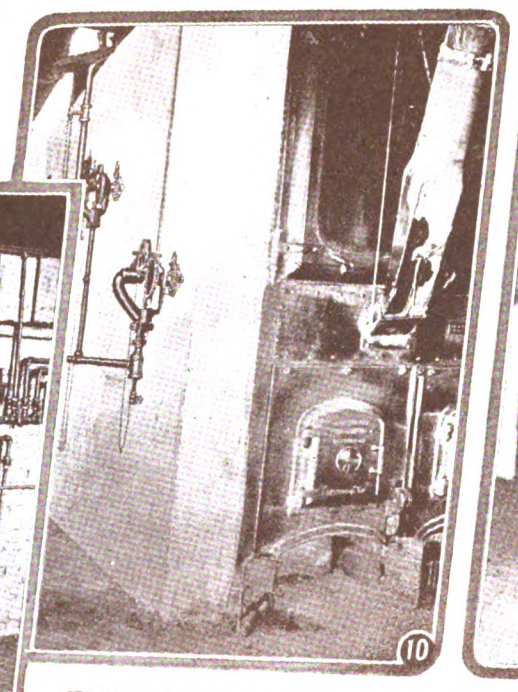


Fig. 10. A typical soot-blower installation. Rotating elements fitted with steam nozzles extend across the furnace between the banks of boiler tubes. They are repassing over a sprocket.

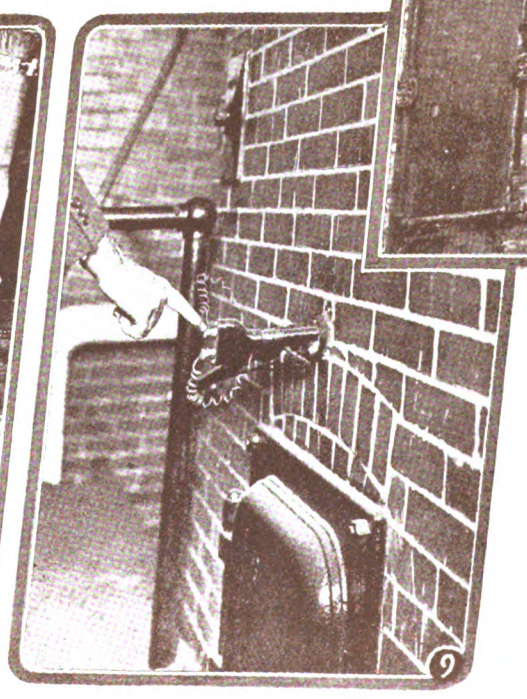


Fig. 9. This is what the terminal end of the thermo-couple looks like. The point of the couple extends into the boiler setting and is sensitive to variations in temperature, transmitting these changes to the electrical recording, or indicating pyrometer.

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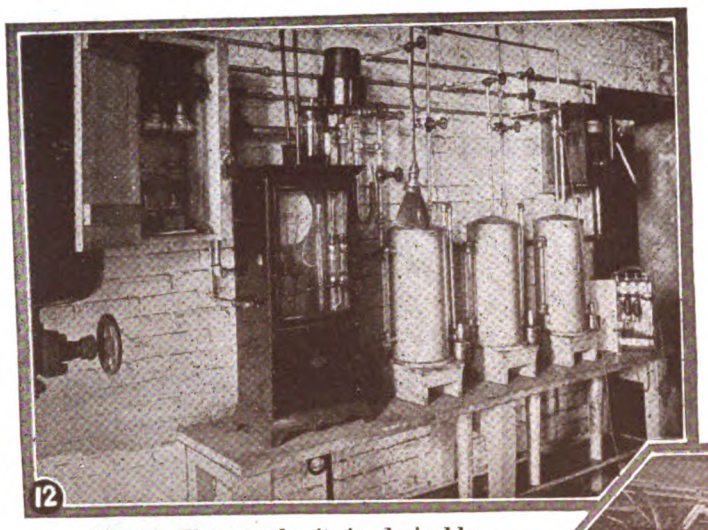


Fig. 12. Frequently it is desirable to use sampling cans in conjunction with a CO_2 recorder. These cans operate to automatically sample the flue gases at regular intervals during the shift. The per cent. of CO_2 in the can at the end of the shift is considered an average reading for that particular boiler during that period. They cost less than a recorder but do not give continuous service. Their value, nevertheless, should not be minimized.

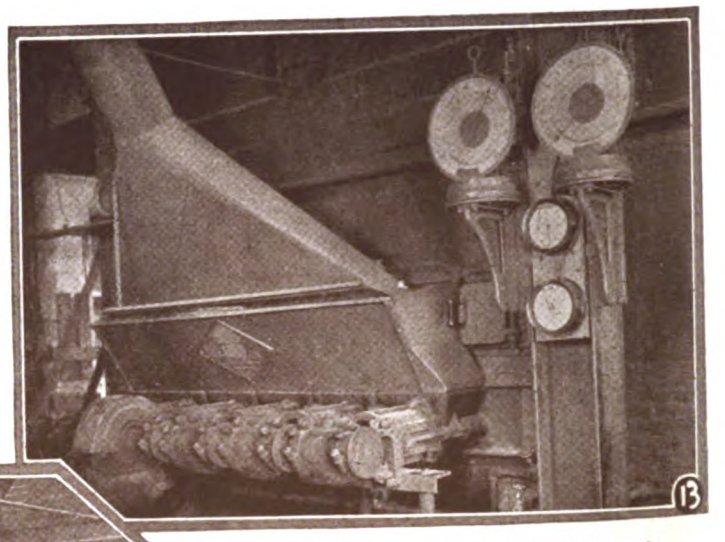


Fig. 13. A stoker installation in which steam flow meters and flue gas thermometers are mounted directly on the boiler front gives an instantaneous check on one of the largest preventable losses in any plant.

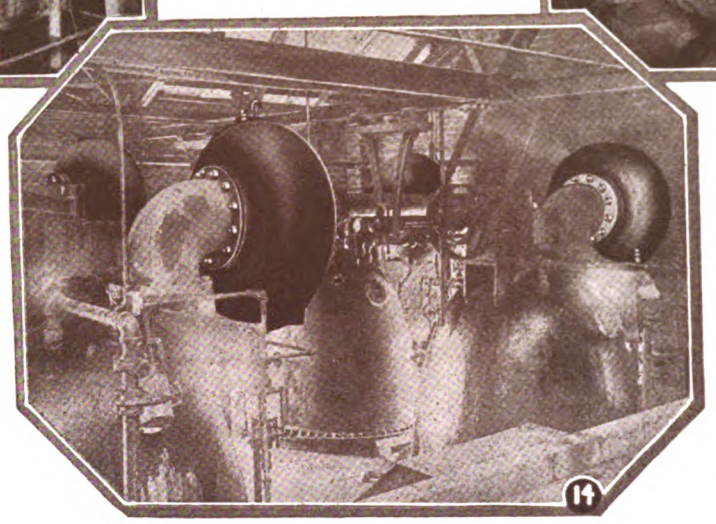


Fig. 14. The use of separators on evaporators or similar equipment insures clean steam and prevents fouling of the product or of the interior surfaces. In many cases such equipment is not only economical but absolutely essential.

coal and ashes have been discussed in a previous article and it is sufficient to say that the installation of a system best adapted to the requirements of the plant will inevitably result in reduced labor costs.

Excessive labor costs are also due to many other operating factors. Boiler cleaning is an item that often shows up pretty large on the cost records. Permanent soot blower equipment, installed in the boiler setting, is far more economical than the steam hand lance. It does the same work better, quicker and cheaper, by reducing the steam consumption required in blowing the tubes, by reducing the time necessary to do the job and by cutting the labor costs for this class of work.

When impurities in the boiler feed water make frequent internal cleaning necessary, labor costs and fuel losses increase proportionately, as pointed out in an earlier article on feed water treatment. By proper treatment of the boiler feed it can be rendered harmless, the period of time between cleanings can be greatly lengthened and the cost of turbining can be reduced to a reasonably low figure.

The cost of repairs, renewals and maintenance is always an important item in the total power cost. In a large number of cases power could be produced at less expense and the

(Continued on page 35)

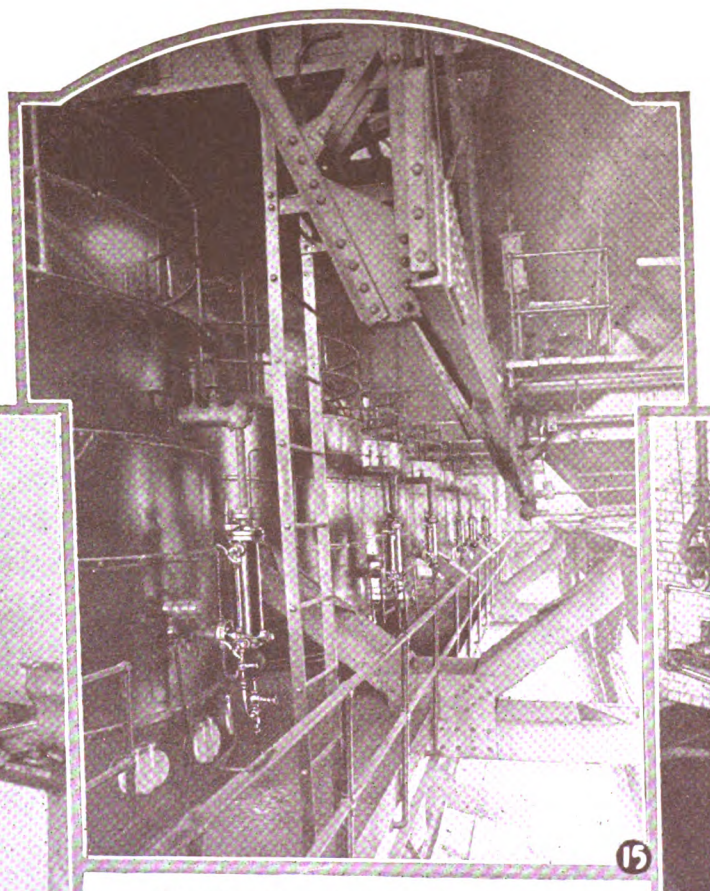


Fig. 15. Safety alarm water columns give reliable and positive knowledge of the water level in the boilers and often call attention to failure of feed water supply or other conditions which might lead to damaging results or expensive repairs.

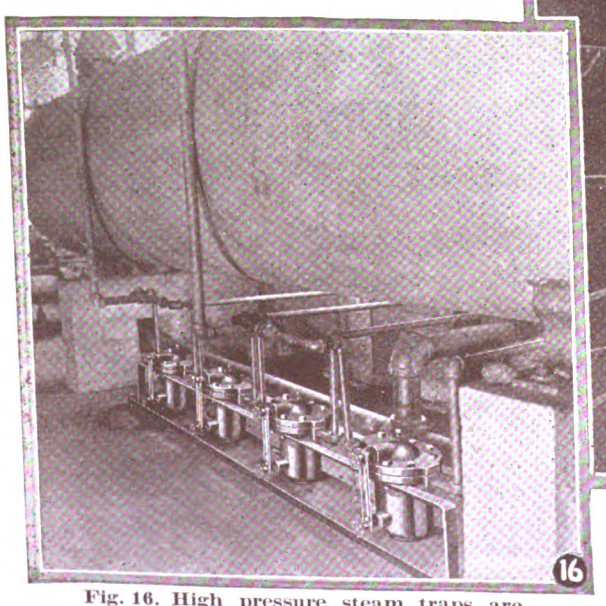


Fig. 16. High pressure steam traps are often essential on certain steam headers. Where they are used, however, it is important that they be given the attention to which they are entitled. Too often they are neglected and fail to operate or discharge live steam to the waste pipe.

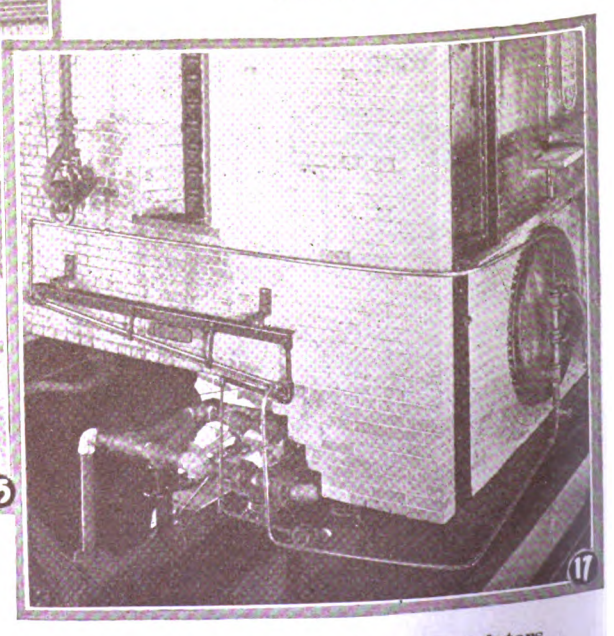


Fig. 17. Automatic feed water regulators control the supply of water to each boiler and, if properly designed, admit this water at the most advantageous time, interfering with the steam capacity as little as possible.

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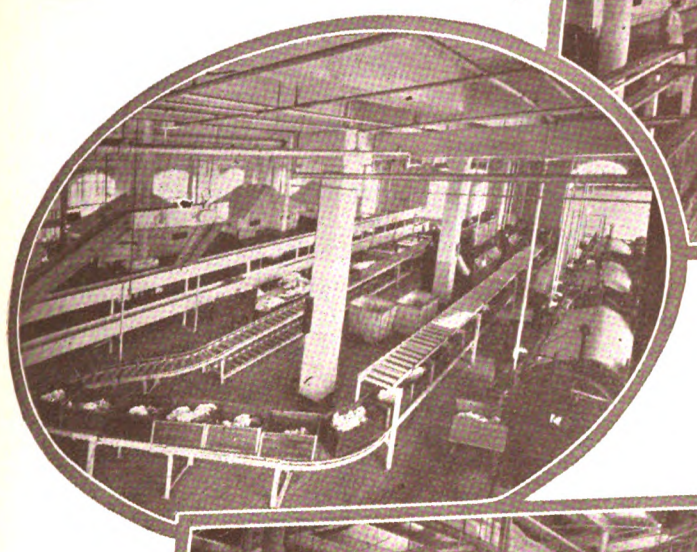
Speeding the Family Wash

The Moving-Production Idea in a Modern Laundry

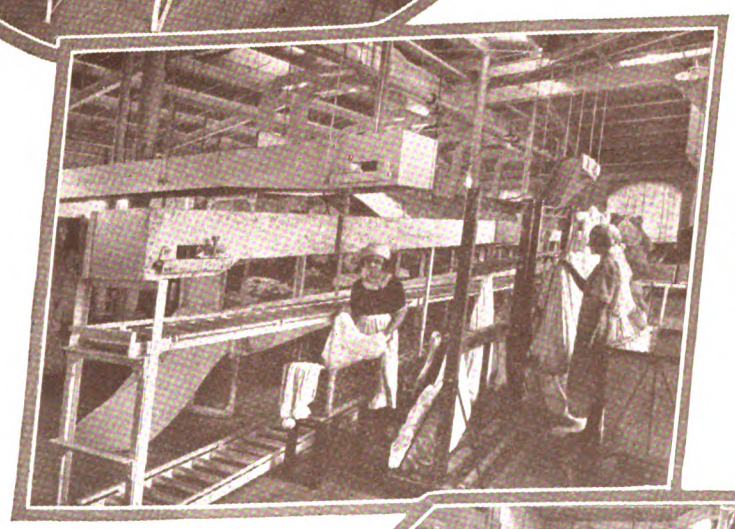
By Ernest H. Rowe



Below—Looking down on the wearing apparel department. Coming to the tumblers at the right by conveyor, articles go from there on the upper conveyor to wrapping tables—thence on belt conveyors to shipping rooms.



Above—The modern laundry certainly bears no resemblance to that of a generation ago!



At the left—The upper gravity conveyor goes to tumblers, the empty nets return on the belt conveyor above, and boxes to be filled come to the operator on the lower gravity run.

Below—Wrapping tables; with work coming in on the lower gravity conveyor, empty boxes returning on the upper. Wrapped parcels go to shipping department on the lower belt conveyor, while identification tags return on the one above.





A view of the wrapping department for flat work.

Below—Here the identification tags and nets return from the wrapping tables, to be started on another of their endless trips.



TAKING the drudgery out of housework has so many aspects that a whole book could be written about it with chapters ranging all the way from high-brow sociology to dustless dustrags. A hundred years ago the wage earners and their occupations began to be taken out of the home and transferred to the newly developed factory with its mechanical power and machines. Now housework itself is taking much the same course, accelerated by the disappearance of servant hand-power just when woman's broadened range of activity makes her want, and makes it possible for her, to be more than a housewife.

Not the least important chapter in the aforesaid book would have for its theme the weekly wash. In fact it's so big (the subject—and the wash, too, sometimes) that it could supply three or four chapters. This is one of them, or rather part of one. There are three household drudgeries that nobody loves: dish-washing, floor-scrubbing and "the wash"; and the greatest of these, to nine women out of ten, is that early-rising, all-day, back-breaking, knuckle-skinning, steamy, sloppy, hot-in-summer-and-cold-in-winter job of washing the family's

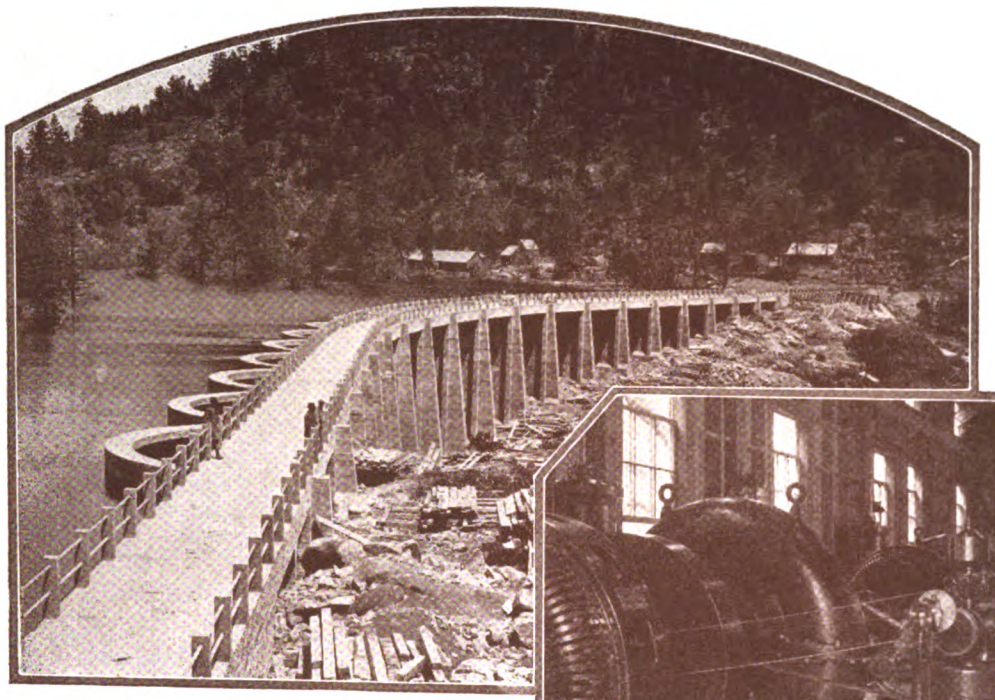
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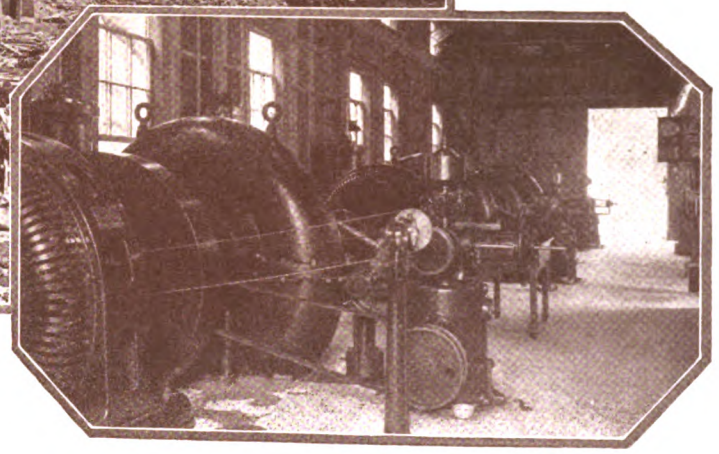
Combining a Water-Supply

The Hetch-Hetchy Project

BY JAMES



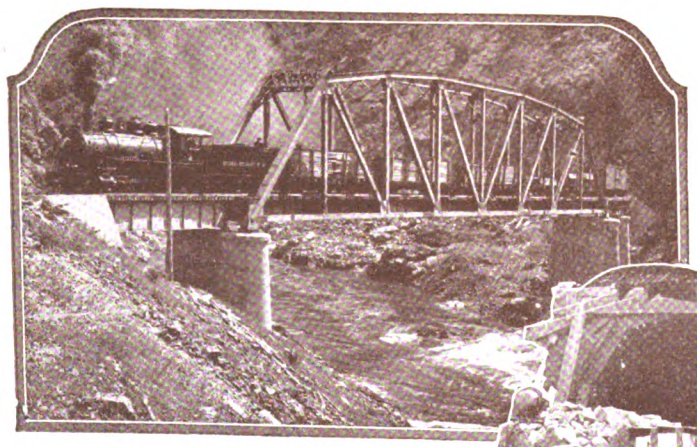
Roadway on crest of multiple-arch dam at Lake Eleanor. Water impounded here is used to operate the hydro-electric plant at Early Intake.



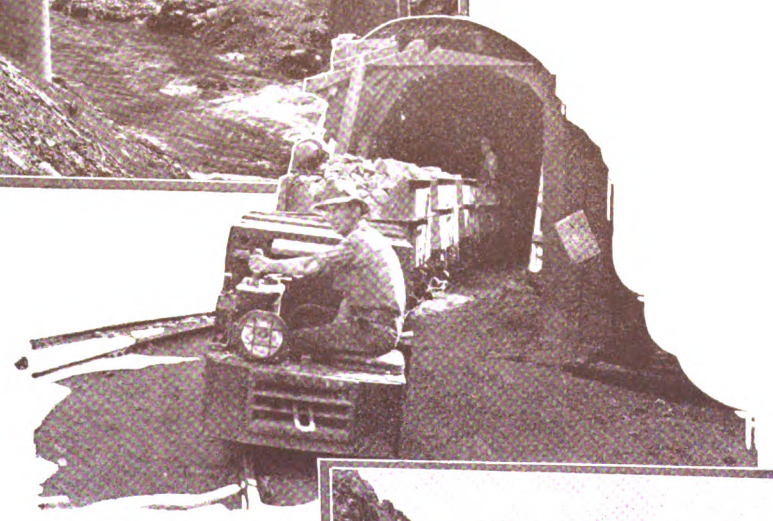
Power house at Early Intake.

WATER is dammed for several purposes. One of the most important, perhaps, has for its object the control of water in flood areas. Another purpose is to develop at one or a few points the hydraulic head distributed over a region of rapids. Still another purpose concerns the development of elevated storage reservoirs designed to furnish the water for a water supply system. The present article deals with an enterprise which involves a very notable instance of dam construction presumably for the primary purpose of serving a large city with water. But it often happens that more than one purpose may be covered. That is more or less the case with the Hetch-Hetchy project just referred to, which will furnish San Francisco with Sierra water and also with electric energy.

It is in fact becoming very customary to utilize the fall of water, dammed with other objects in view, to develop electric current for power purposes. The great Gatun Dam of the Panama Canal serves primarily the purpose of creating Gatun Lake through which a very large section of the canal has its course and by whose considerable area the flood waters of the old torrential Chagres River are controlled. Two purposes are here served. In fact, a third is covered. All lock canals require elevated water to supply the locks. At Panama, Gatun Lake takes care of the require-



Hetch-Hetchy R. R. crossing of Tuolumne River, whose water is a chief dependence of the Hetch-Hetchy Project.



Portal of Priest Tunnel. A muck train, hauled by electric storage battery locomotive.



The Hetch-Hetchy dam site, before the beginning of construction work.

Soon after excavation work began for the Hetch-Hetchy Dam.



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r-Sup nd Power Development

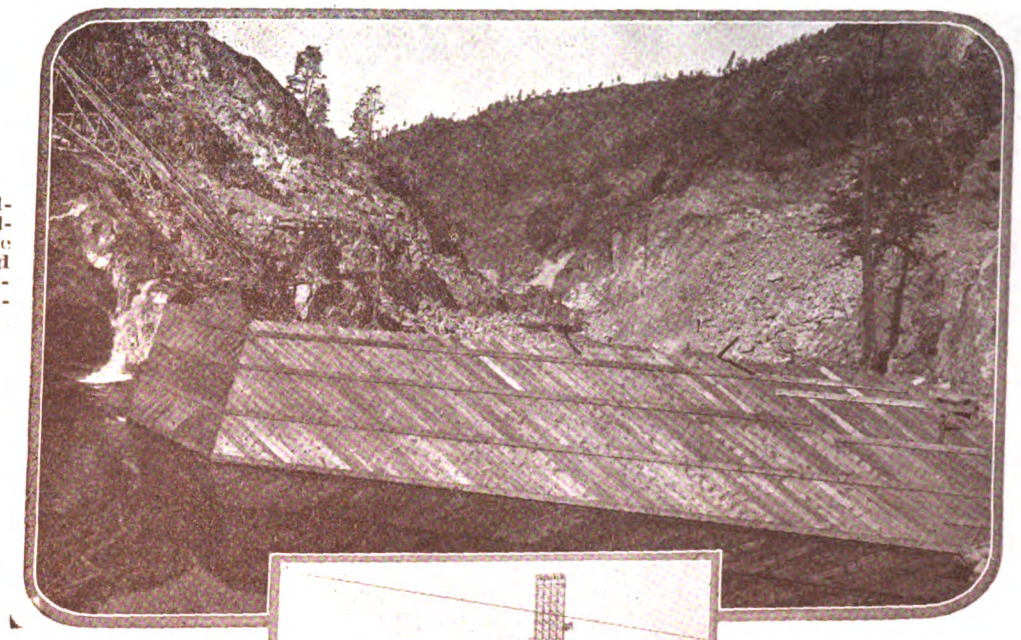
Hetchy to San Francisco

EELMAN

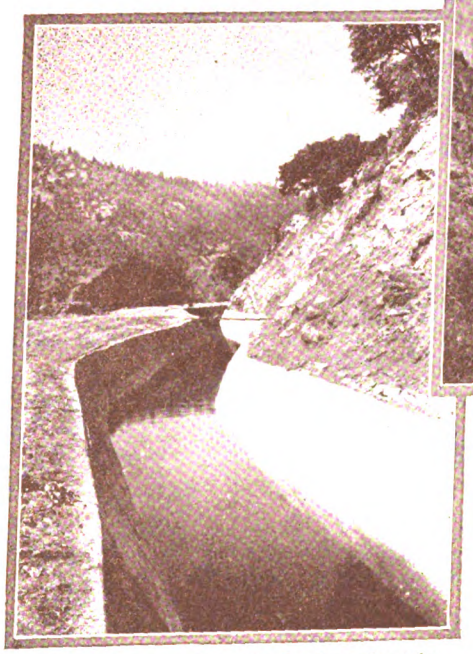
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big dam makes possible the
formance of all these func-
ns, the Government has in
dition provided for a hydro-
ctric power plant for the
rpose of utilizing the fall of
ste water from Gatun Lake.
The San Francisco project,
own as the Hetch-Hetchy
ater Supply, is to bring to
e city and smaller centers of
pulation in the neighborhood
supply of 400,000,000 gallons
r day. Some of this water
ill come from the neighbor-
od of the Yosemite Valley
d some from regions not so
stant. However, the consider-
ion that San Francisco will
eed a great deal more power
an is now being delivered by
cal plants has brought about
me modification of the con-
truction plans. It was intend-
d that hydro-electric plants
hould be constructed close
pon the completion of the first
queduct unit carrying water
rom the Tuolumne River to
he city. It now transpires
hat the old water supply sys-
em is to be developed to the
oint of taking care of the
vater needed for the city for
he next decade. This releases
he Hetch-Hetchy project
from any great pressure for
haste, in so far as delivery of
water to San Francisco is
concerned.

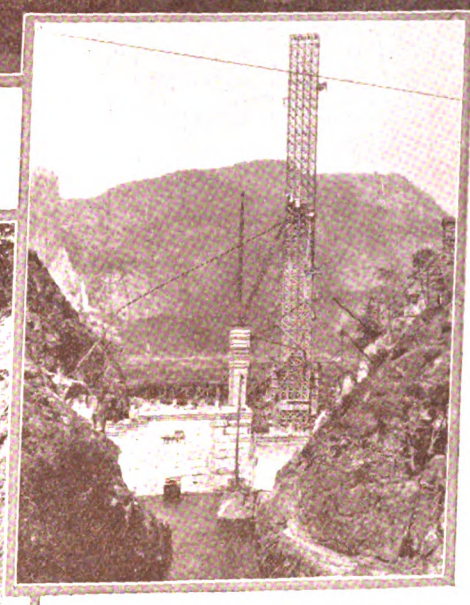
On the other hand, the city is in such urgent need of power that the hydro-electric feature of the great enterprise is to be

(Continued on page 72)



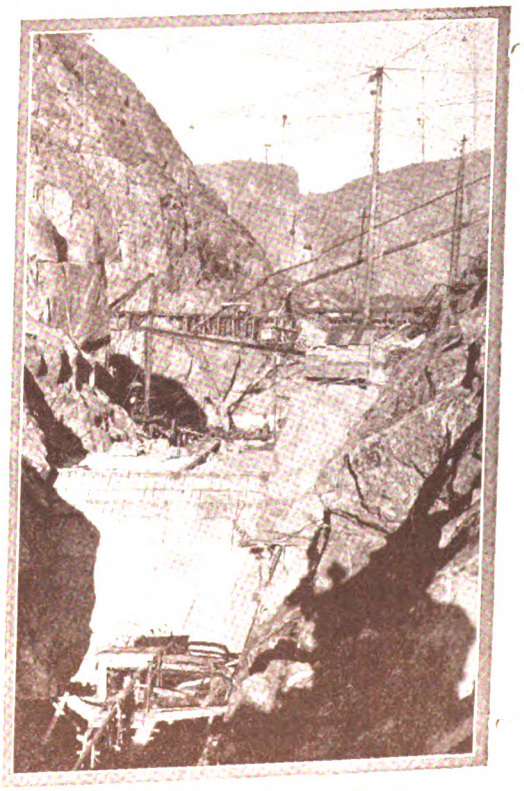
Diversion dam, for guiding the water of Tuolumne River into the tunnel on the left, and thus facilitating construction of the Hetch-Hetchy Dam.





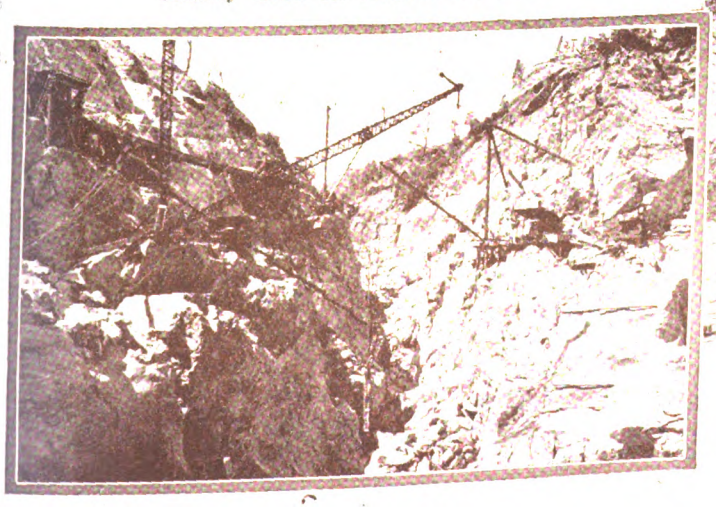
A 350-foot elevator tower for hoisting concrete to the distributing chutes at the great dam.

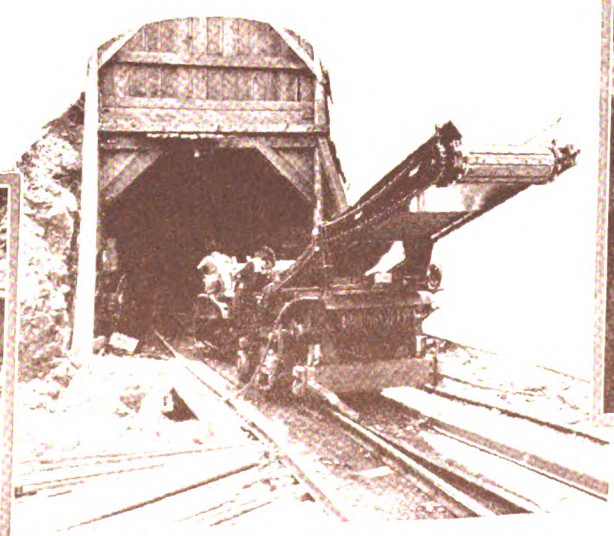
The Lower Cherry hydro-electric power development is served by this concrete-lined canal, whose daily capacity is 130,000,000 gallons.



Hetch-Hetchy Dam as it appeared on November 20, 1921.

General view of site of the Hetch-Hetchy Dam on August 15, 1921.





Mucking machine at the portal of one of the tunnels.

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Developing the Full Capa

Tractor-Trailer Trains

BY MATTHEW

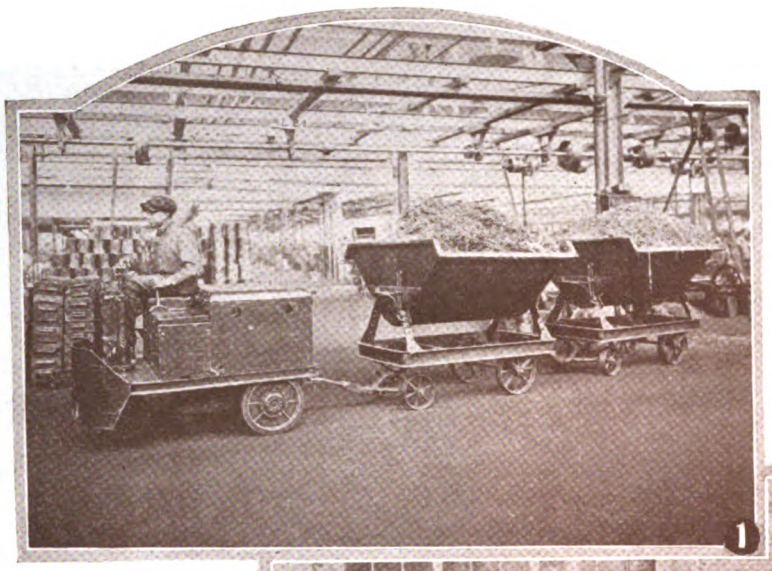


Fig. 1. Side dump hopper trailers bringing metal scrap from machine shop.

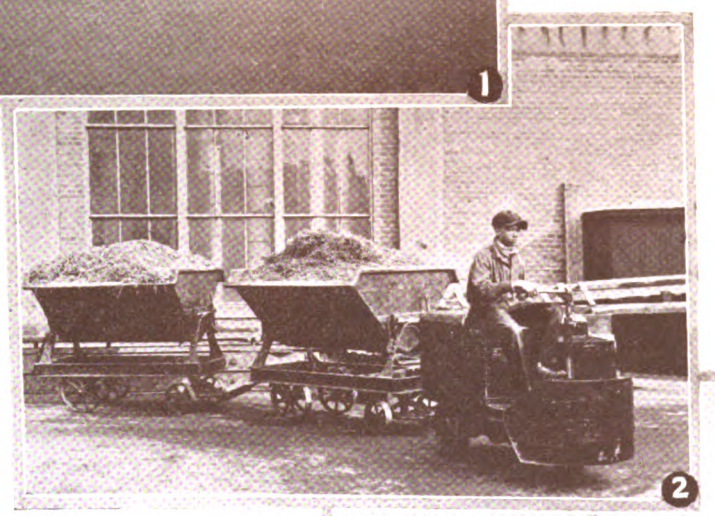


Fig. 2. Same load as figure 1, on hard roadway, going to dump.





Fig. 3. Tractor driver driving load to empty space in dumping pile.

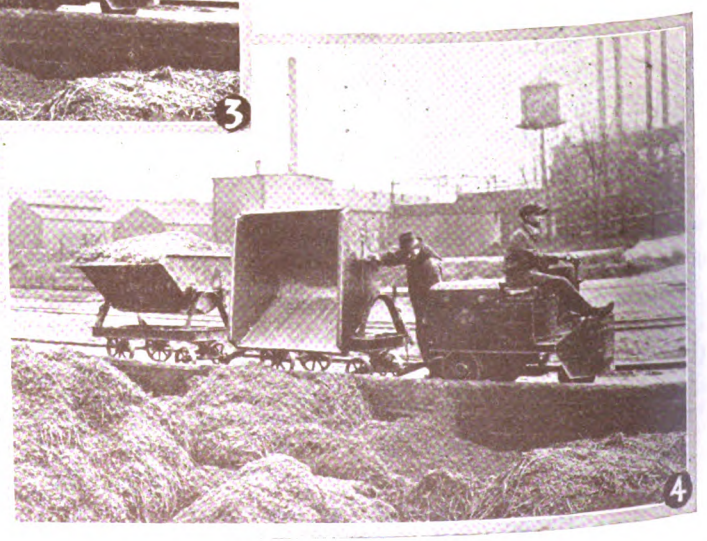


Fig. 4. Transporting and unloading of trailers is the keynote of economical handling.

Fig. 5. An excellent example of the trackability of four-wheel steer trailers. Wherever the tractor can get through the trailer will follow, no matter how long the line may be, when this type of trailer is used.

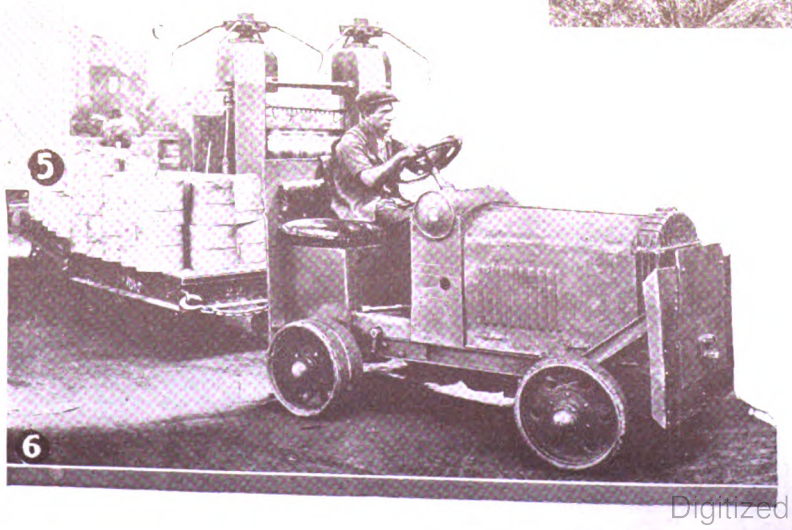


Fig. 6. In heavy machine and foundry work where there is plenty of space, the gasoline tractor is recommended for motive power.

AN editorial in the *New York Tribune* for July 23rd, 1923, calls attention to the migration of negro labor from the South, and the introduction of a bill in the Georgia legislature which will make it a felony to solicit labor in Georgia for other states, and the consideration of a bill in the Alabama legislature to tax labor agents $5,000 for every county in which they operate. Other states in the South are seeking almost in desperation, a means to check the outflow of colored workers.

The following is quoted from this editorial:

> "The migration which has been in progress for several years shows no signs of abatement. Last year more than 3% of Alabama and South Carolina negro farm hands, moved North. Georgia lost 13%. This year the exodus is even more alarming. The cotton planters have been exceedingly hard hit."

The South has long depended upon negro labor to carry the burden of moving ma-

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cities of the Factory Tractor

in Intra-Plant Haulage

W. POTTS

terials, and most of this work has been done by hand, but at the present time, a large number of inquiries are being made to material handling equipment manufacturers by Southern industrialists, to see how this equipment can be applied to their labor needs. Figures 1, 2, 3 and 4, also figures 9, 10 and 17, show why the negro comes North, and engages in industrial work. In each illustration mentioned, the tractor driver is a negro, and while they are not the most dependable type of help, they quickly acquire the knack of running power equipment, particularly if a little attention is paid in educating them. They naturally take the line of least resistance, as shown in the first four illustrations.

Figure 1 shows a tractor starting with a load of steel shavings which have been collected in the shop, and placed in hopper body trailers. Figure 2 shows the same train passing along a driveway outside the shop; while figure 3 shows a train drawn up along side of the dumping pit, and



Fig. 8. Long trains of trailers, heavily loaded, and operating over asphalt or concrete roadways, save enormous sums in intra-plant handling.

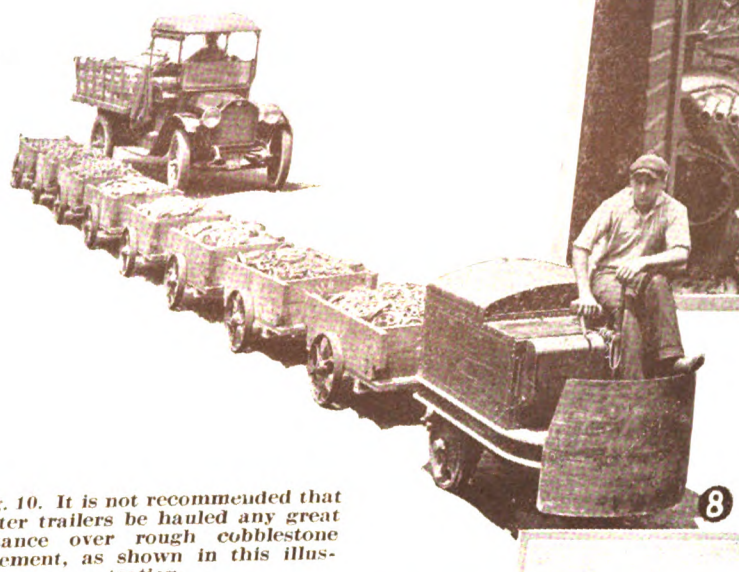


Fig. 10. It is not recommended that caster trailers be hauled any great distance over rough cobblestone pavement, as shown in this illustration.

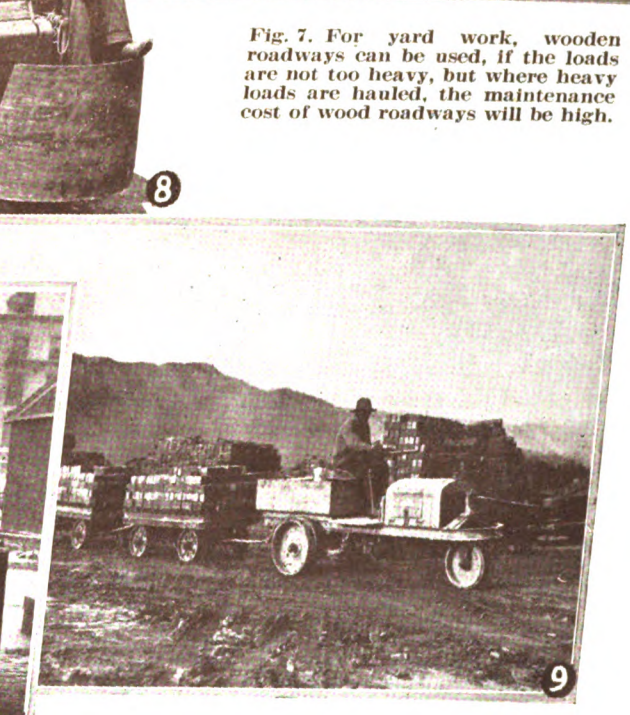


Fig. 7. For yard work, wooden roadways can be used, if the loads are not too heavy, but where heavy loads are hauled, the maintenance cost of wood roadways will be high.



Fig. 9. On outside work, large wheel trailers and gasoline tractors make the best combination.



Fig. 11. Handling refuse in the narrow aisles of stock yards has always been a problem. Electric trucks and trains of trailers have solved this problem with large money savings. Note "S" turn of trailer train.



Fig. 13. When loads are light, long trains of trailers can be hauled. This is a system of handling barrel staves in the cooperage plant of a large oil company.

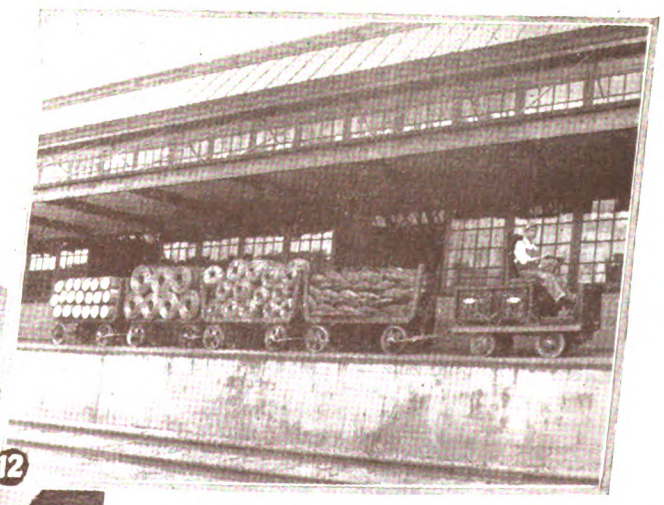


Fig. 12. The secret of economical operation is heavy loads. This shows a tractor handling approximately 6 tons of material on four trailers.

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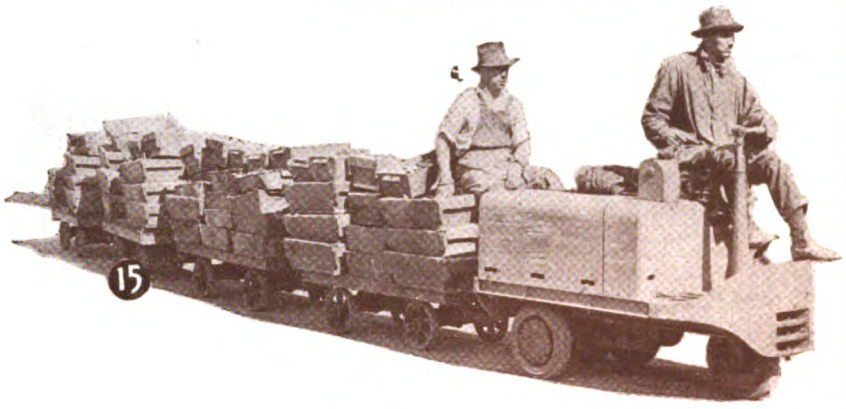


Fig. 15. While concrete roadways wear out somewhat quicker than asphalt roadways, under tractor trailer traffic, the reduced frictional losses offset the additional maintenance expense.

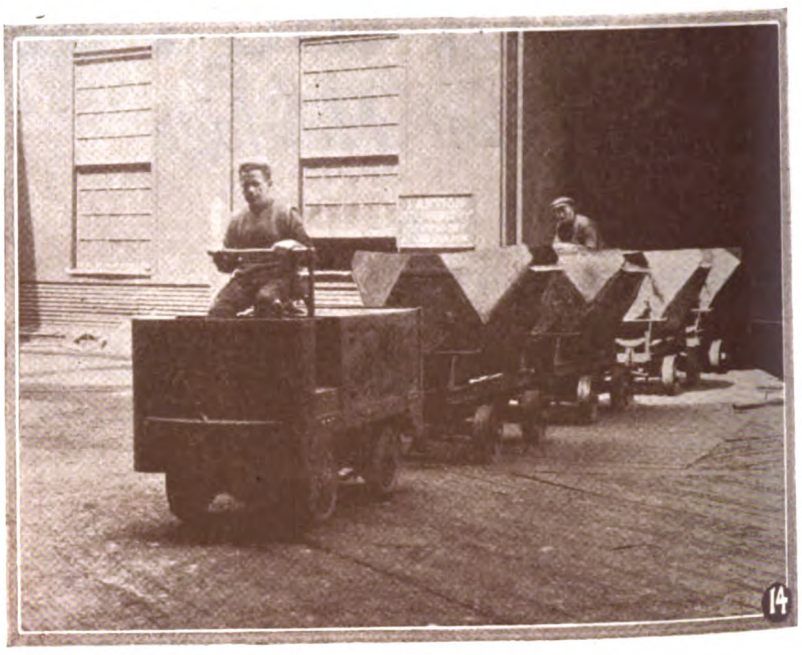


Fig. 14. Some municipalities have investigated the use of material handling equipment. The tractor shown is hauling dump body trailers used for coaling the Staten Island ferries which ply between Port Richmond and New York City.

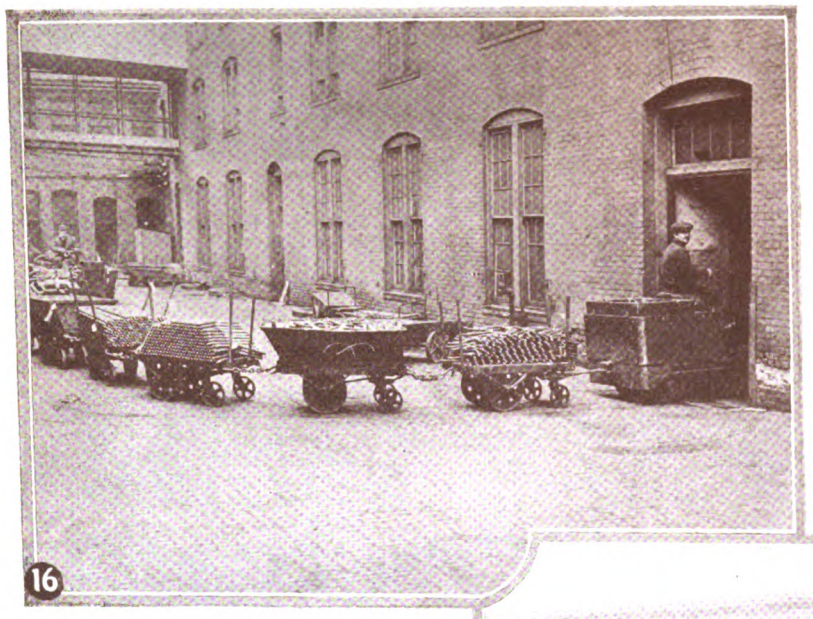


Fig. 16. Tractor making delivery of six trailers loaded with approximately 15,000 pounds of material. Before delivery is completed, the tractor passes through four swinging doors, the only labor required being the tractor driver.

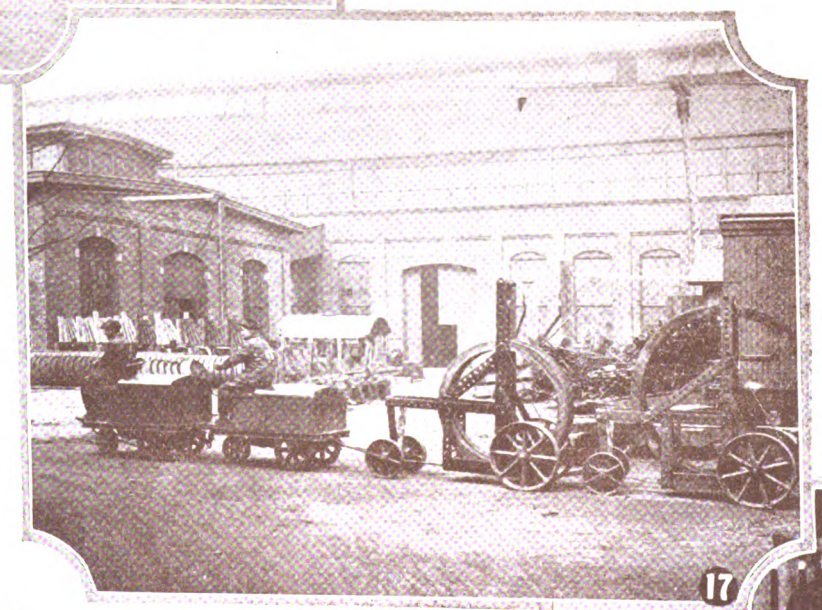


Fig. 17. Special trailers for handling cumbersome materials are accessories that help to keep the tractors busy, and reduce handling expenses. These trailers are handling locomotive wheel tires.

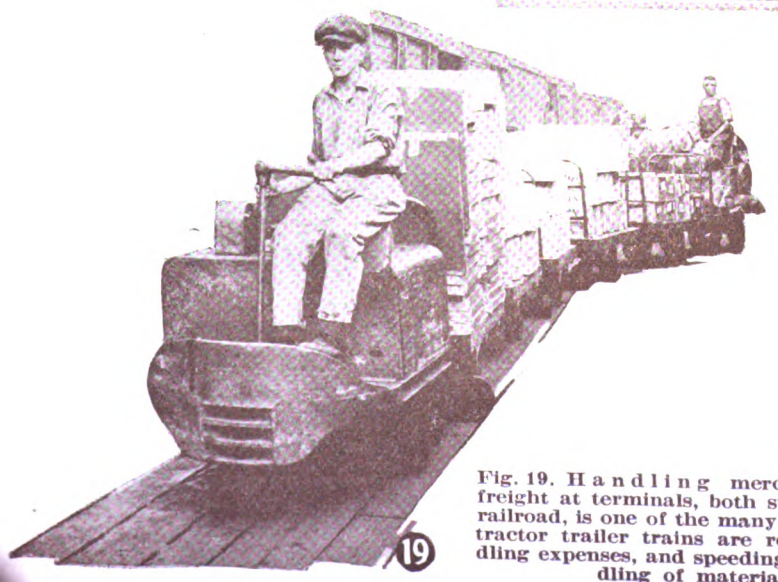


Fig. 19. Handling merchandise and freight at terminals, both steamship and railroad, is one of the many places where tractor trailer trains are reducing handling expenses, and speeding up the handling of materials.

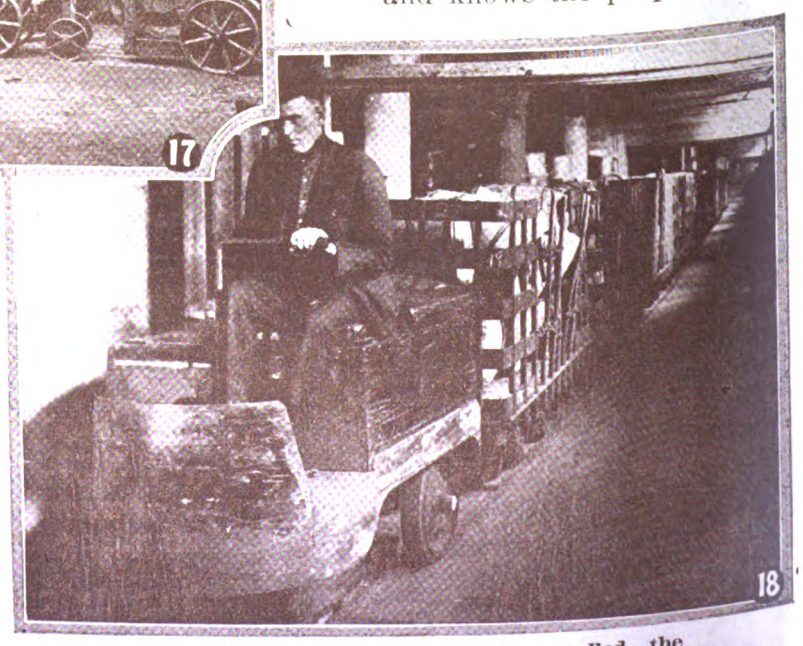


Fig. 18. If tracks are already installed, the electric tractor can be used for hauling of cars. This installation is at a receiving station of the Chicago Tunnel Company, which uses a number of these tractors.

figure 4 shows how the load is dumped by a man, who also trims the load in the storage bin. The driving of a tractor being so simple the negro is particularly delighted and satisfied while doing this easy work, but if the work were performed by the average intelligent white man, it would be done better, as certain negro characteristics have not been eliminated, and will not be eliminated unless extensive education is done for the race.

There is no need for the Northern industrialists to strip the Southern states of negro labor, but the Southern industrialists can do much to keep the present help in its own fields by installing material handling equipment. The South is accustomed to the Negroes, and knows the proper way to

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Fig. 20. This is a part of the material handling installation that saved $200 per day in handling costs at the Minneapolis Steel & Machinery Co.

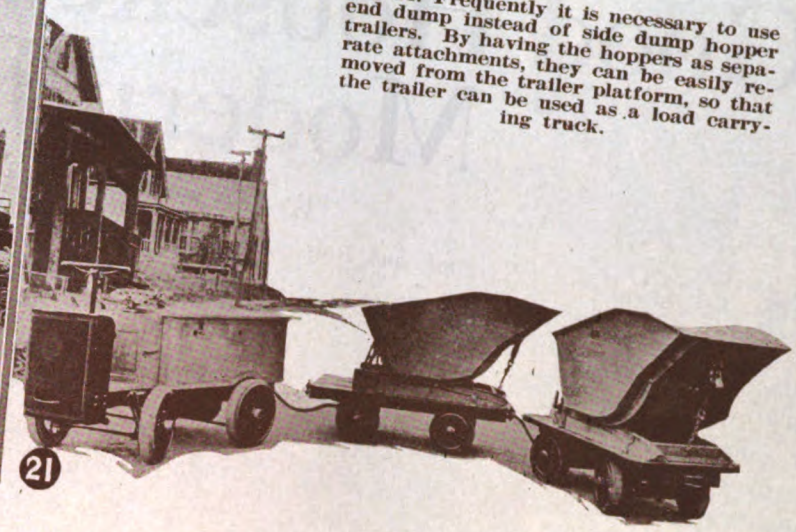


Fig. 21. Frequently it is necessary to use end dump instead of side dump hopper trailers. By having the hoppers as separate attachments, they can be easily removed from the trailer platform, so that the trailer can be used as a load carrying truck.

handle them, while the North will have a hard time assimilating and becoming adjusted to large numbers, as we do not have the restrictions in the North that are now provided in the South regarding the negro question.

This is shown by the recent development in the last year, where the negroes have taken over a considerable portion of the medium class white residential section, along St. Nicholas Avenue, in New York City. Undoubtedly this is caused by the influx of negroes from the Southern States, as mentioned previously.

Too much has been said regarding the necessity of obtaining cheap labor for plants in the North, and it does not matter whether this labor is imported from Southern

(*Continued on page 44*)



Fig. 22. Moving heavy machinery quickly and cheaply is another place where the tractor can be used to advantage.



Fig. 23. This tractor is making a difficult turn in congested portion of the punch and shear department, with three trailers carrying approximately 6,300 for delivery to forge shop. The wheelbarrow inside the white aisle lines, is in transit but waiting for tractor to pass, the tractor having the right of way.



Fig. 24. Handling assorted merchandise is difficult with hand trucks while flat platform trailers hooked in a train can handle this class of material quickly and cheaply.

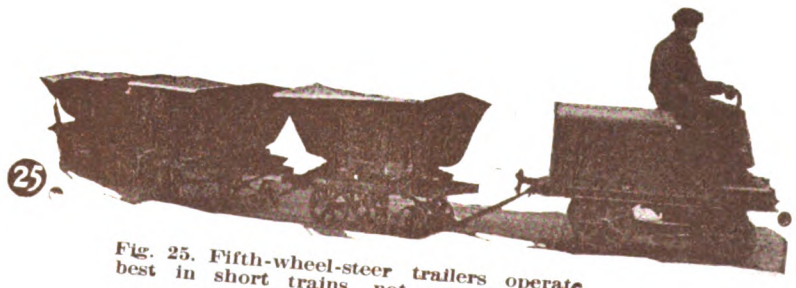


Fig. 25. Fifth-wheel-steer trailers operate best in short trains, not exceeding five trailers in length.

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Good Housekeeping in the Modern Plant

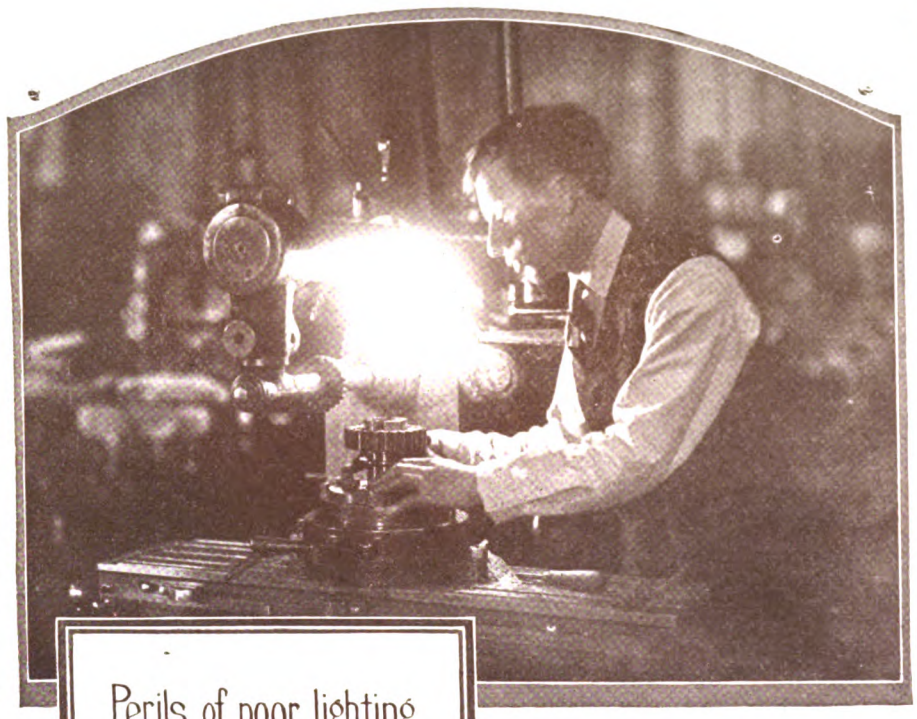
By Sanford DeHart

Director of Hospital, and Employment Manager, The R. K. LeBlond Machine Tool Company.

THE problem of increasing output in the face of the present labor shortage is being solved by many industrial managers in various ways. New methods are being devised to prevent accidents and sickness among the workers. An ingenious industrial manager has reduced the accidents more than 60 per cent. in a plant that was considered hazardous and noted for its high frequency accident rate. This manager is of the opinion that there is no better plan to save labor than to reduce accidents and sickness. Cutting down a large part of shop accidents is equivalent to adding hundreds of new men.

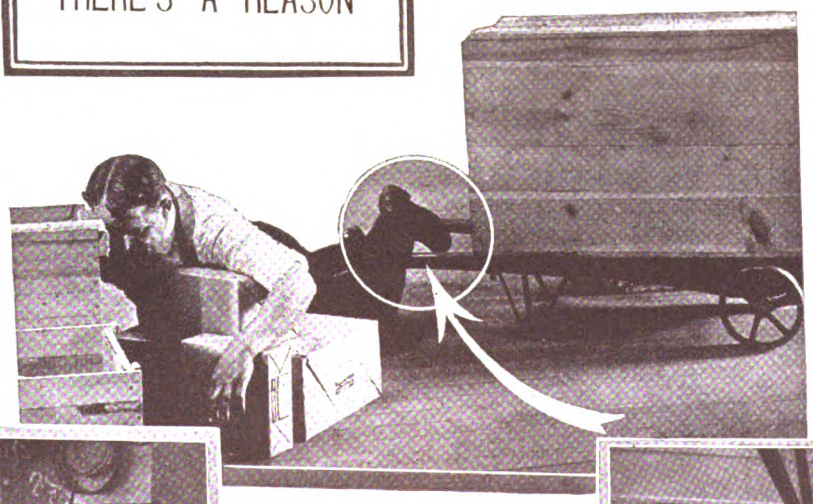
A recent survey on the causes of waste in industry, compiled at the direction of Herbert Hoover, showed that the largest waste in industry was due to sickness and accidents.

Industrial managers have found that reducing accidents and sickness in the shop is largely a matter of good shop housekeeping. We are no longer amazed when we read that a shop employing several thousand persons spends $100,000 a year to keep the shop clean, and this same shop goes the entire year without a single serious accident to one of its thirty thousand workers.



One of the most prolific sources of accident, to say nothing of eye-strain and its effects on health, is improper illumination.

One of the posters used to drive home the idea of proper lighting.



This may be an extreme example—but it happens to be an actual case—of poor housekeeping; an invitation to disease, fire and accident.



Obstructed aisles are not merely untidy; they are a source of constant danger.

There is a psychological aspect as well as an economic one to this problem. The young man who is injured the first day or two that he is employed is not going to be with that concern very long. If he does not leave of his own volition, he will be persuaded to do so by his family. Unfortunately, one of the curious manifestations of mass psychology in the shops is that if one quits, several usually follow.

Another important phase of good shop housekeeping is the impression it makes on the applicant for employment. One employment manager of a large plant of national importance told me recently, he has sold the job to the applicant on the plant's cleanliness and appearance, when other arguments have failed. This employment man has one of his assistants take the prospective employee through the shop so that he visualizes for himself the care that is taken to make the shop a safe and inviting place to work.

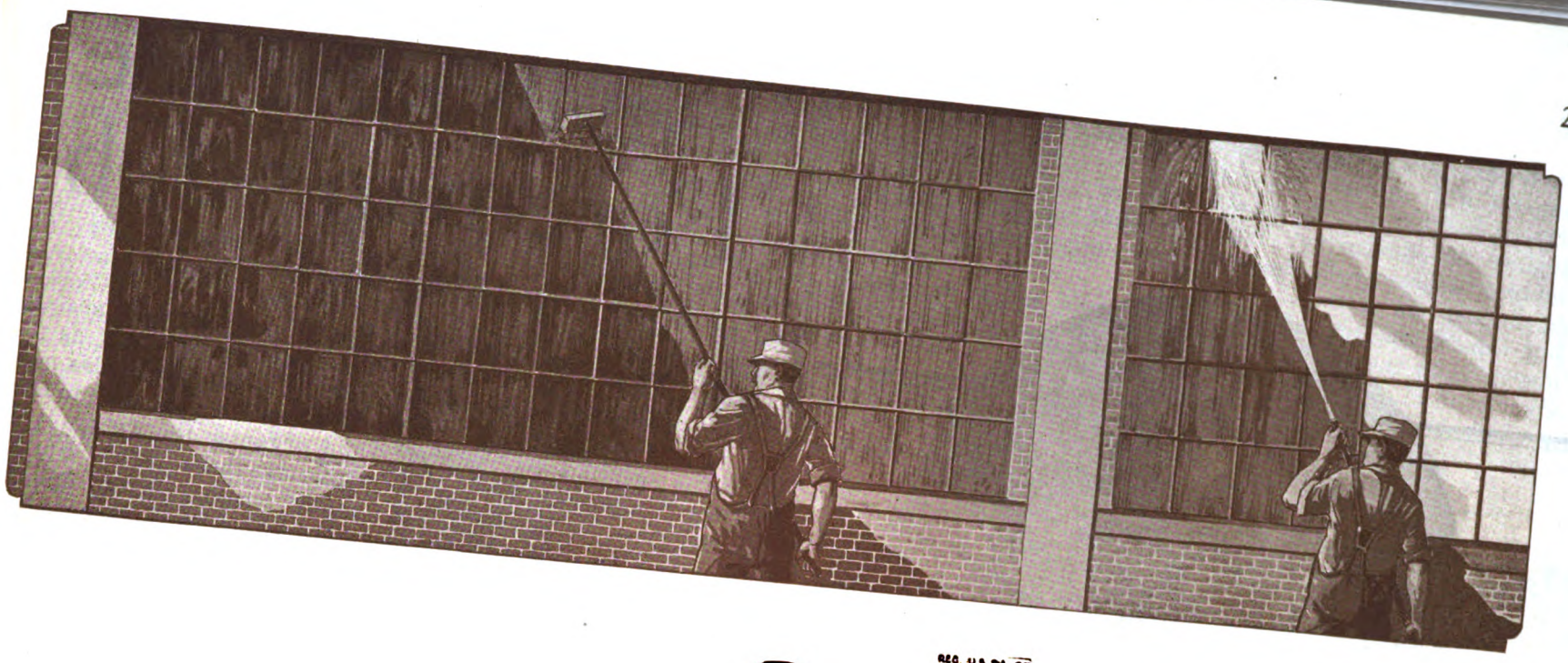
From the foregoing it may be gathered that good housekeeping in the shop is not only the solar plexus of accident and sickness prevention, but a good selling argument in interesting and retaining the new employee.

(*Continued on page 68*)



Inspection day in a large machine shop.. Frequent inspection is a big factor in stimulating good housekeeping.

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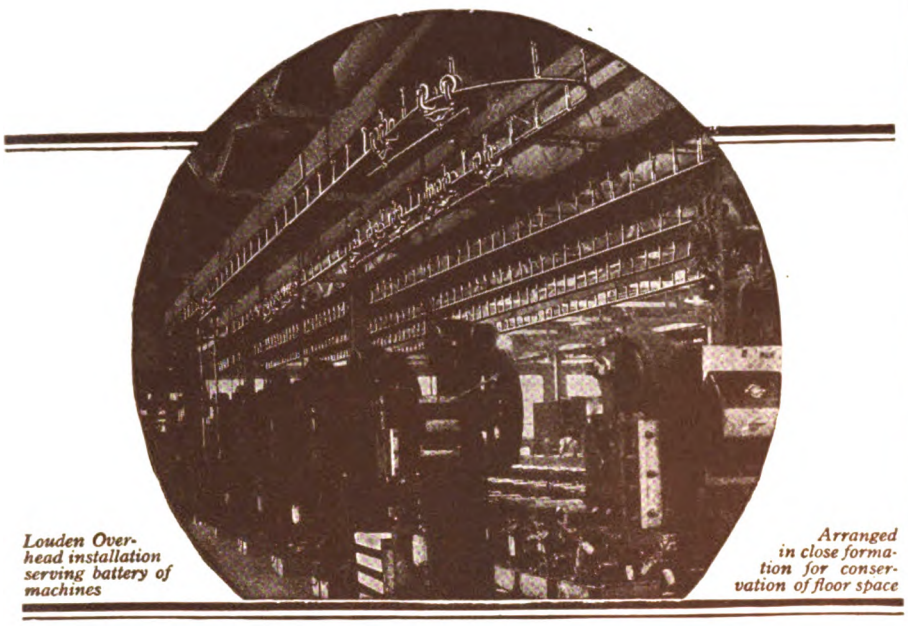
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Analyzing the Foreman's Job

BY GEORGE W. GRAY

"WHAT are foremen for?" asked a lecturer at a recent gathering of factory workers.

"To bawl out their men," answered an Irish voice in a rich brogue. The burst of laughter and applause which followed showed at least that the meeting was in good humor.

"To keep down loafing and soldiering," said another, followed by more applause.

"To hire us and to fire us," answered a third man, and brought down the house.

The lecturer straightened his face and repeated his question. "Think of your own factory and your own experience there," he said, "and tell me what the foreman's job is, as you see it."

"To keep an eye on things for the management," volunteered one man.

"To boss the men in the department," answered another.

"To break in green men and show 'em the ropes," replied another man, an old-timer who was apparently not accustomed to the modern system of shop training departments.

A serious-faced young man who was assistant foreman in a machine shop held up his hand, was recognized, and rose to his feet.

"Foremen," he announced, "are the supervisory force, the squad-leaders of industry, who see that the men do their work with the least expenditure of time and the least waste of material.

Ah ha!—a burner of the midnight oil!

"Foremen," proclaimed another man, in a high-pitched voice, "are the police officers of factory work."

More discipline!

And so it went. Practically every reply to the question reflected in some way on the foremen's handling of his men, on his functions as taskmaster, disciplinarian, leader.

But do these suggestions embrace the whole of the foreman's job? A recent widely-circulated text-book on the subject of foremanship analyzes his functions into six, as follows: (1) to develop his men, (2) to lead his men, (3) to plan and organize the work, (4) to supervise the work, (5) to make improvements, (6) to coöperate with the management. These functions can easily be classified into two groups: those that have to do with the work or technique of the department, and those that have to do with the human element. The foremanship we may therefore define as a two-phase job: it calls for technical ability and managerial ability.

Very little is heard in criticism of the typical American foreman as a technician. Usually he is a skilled man in his line and able to make good in any reasonable test of technical ability. If he is a foreman of a battery of drill presses, he knows drills down to the last intricacy. If he is a foreman of chocolate dipping in a candy factory, or of cold drawing in a steel mill, or of finishing in a furniture factory, or of any other specialty, usually he knows pretty thoroughly the technique and the machinery of his specialty.

It is in handling the human element within his department that the foreman all too often shows his deficiency. The replies of the workmen quoted at the beginning of this article, informal and somewhat hilarious though they may be, give at least a hint on this problem.

The average up-from-the-ranks foreman is not a good manager. Usually he is not picked on any basis of managerial ability, but rather on the basis of technical ability. When the old foreman quits, dies, or is discharged, the usual plan has been to pick the best worker in the department and reward him by promotion to the foremanship. His education and training have all stressed the technique of his work; little or no attention has been given to the managerial functions. It is no wonder,

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's Job

GRAY

therefore, that the average up-from-the-ranks foreman so often falls short of perfection as a manager and leader of his men.

A great deal has been written since 1917 about the foremanship, its opportunities, its shortcomings, and its future. During the industrial emergency which the war brought, we discovered that the foremen are the "non-coms of industry," the "key-men of production," and many were the managers who hastily improvised schemes for the keying-up of their key-men. These efforts ranged all the way from inspirational talks by the management to full-fledged educational courses, with ponderous textbooks, reference reading, lectures, written exams, and a diploma of graduation at the end of the course.

A factory in the West was contemplating the establishment of a foremens training class. The manager, a very conscientious man who had done much reading on the subject and was steeped in theories of industrial education, decided that what his foremen needed was a course of lectures in the history of the company. His organization had suffered from heavy labor turnover during and following the war, and in the manager's opinion the department heads needed to be imbued with the ideals and standards of the business such as a review of its history might give.

When old Colonel Blank, a heavy stockholder and himself an industrial executive of wide experience who had retired, heard of this educational project, he paid a visit to the manager.

"Don't waste any time on history," advised the Colonel. "Show 'em how to call down a man without insulting him, and how to praise good work without lollypopping."

The manager was somewhat nettled but managed to conceal it.

"Why, our force is almost entirely a new crew, Colonel," he explained. "They don't know anything about the past of the company, how it was established, how it has grown, the evolution of our products."

"Does it really matter?" asked the Colonel. "They are skilled in the work, all right, aren't they? They know our present products, and the processes, don't they?"

"Yes," admitted the manager, "but they need keying-up. Our labor turnover is enormous."

"And you think if you give 'em a college course in what a glorious concern they're working for, they'll fall to, and cheer for dear old Alma Mater, and nobody'll ever have the heart to quit, eh"

The manager flushed, turned to his desk, and the Colonel left, smiling. The course was never given.

Somewhat at the other extreme is an experience that was told me of a New England factory. It is a large concern with an extensive educational work which had been placed under the charge of a learned specialist who had had considerable experience in college teaching. He organized courses for apprentices and beginners, a course for salesmen, and then decided that the foremen were next. For the foremen's course he conceived something that should be technically com-





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plete, a course that would round out the foremen and bring them abreast of everything in the industry. He spent a year visiting other factories, consulting authorities in technological schools, selecting the text-books to be used, laying out a schedule of lectures, and planning the system in detail. It was truly a comprehensive curriculum, including mathematics, blue-print reading, physics, chemistry, and machine design, and such allied subjects as economics, sociology, civics, and psychology.

When announcement of this course was made, a committee of foremen waited on the educational director and politely informed him that they would be unable to take it. The foremen said that no doubt they were ignorant of the subjects offered, and might be benefited by the study, but that the factory work was exacting and demanded their time and energies, and they were really too busy to go back to school.

So that educational project fell through, and shortly afterward the educational director resigned.

The foregoing examples are not cited as evidence of the impracticability of foremen training, but as instances of a wrong approach to the problem. The foremen in the New England factory were right in saying that they were too busy to go back to school, for such an education as that outlined for them would have required their concentrated effort, and could hardly have been taken up seriously without borrowing time and energy from their work. Training on the job is not an impossible scheme; in fact, many industrial educators regard it as the best method of industrial training for adults. And there are numerous instances on record of successful results secured through training foremen on the job; results reflected in immediate improvement of their work, their handling of the men under them, and their cooperation with the management. But such results have been secured with courses that are carefully planned to steer as clear as possible of the merely theoretical or academic approach to industrial principles and problems, and to make the training intensive, consistently concrete, and tied up closely to the live everyday problems of the foreman in his department.

And so too with the project of the manager of the Western factory for a course in company history. These things are all right as incidentals. Inspirational lectures, preachments on company loyalty, and the like may work in with some program of training, but to make them the whole training is rather overbalancing their value. If the foremanship in that plant needed to be improved, the chances are that what the foremen needed most was some instruction and drill in the principles of handling the human problems that arise. The fact that the company was suffering from excessive labor turnover shows that. Whiting Williams found in his sojourn among coal workers and steel workers that a chief source for unrest and labor turnover among laborers is the attitude

(Continued on page 32)

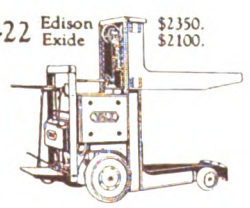
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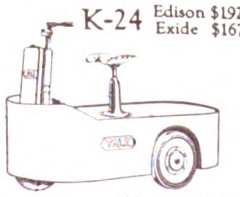
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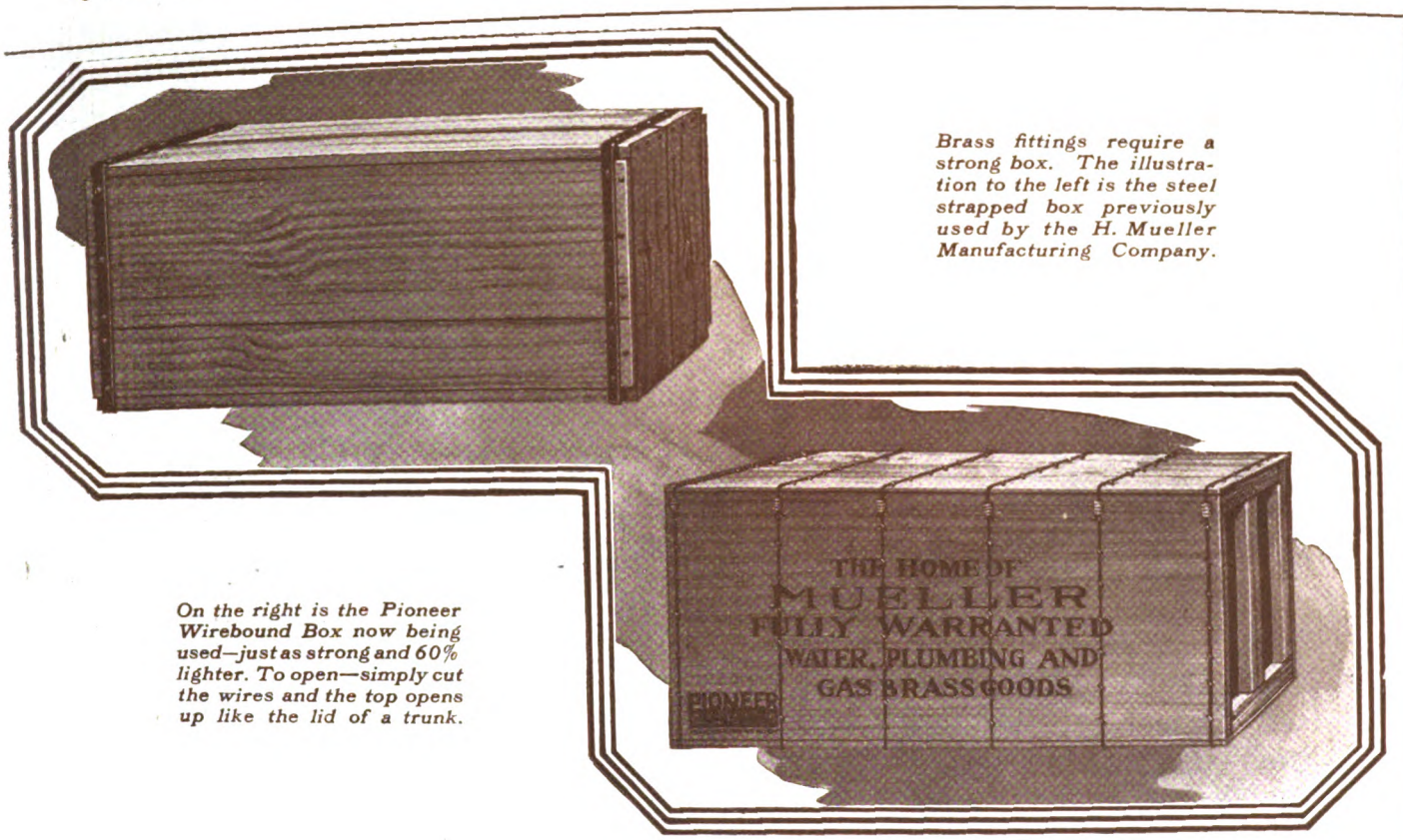
and treatment they receive at the hands of their foremen.

Another point on this question of what kind of training for the foremen, is the fact that foremen do not take readily to a program of technical study. Some do, of course—there are exceptions to every statement made in this article—but I am speaking of what is common and prevalent. If an educational expert, either from the inside or from outside the organization, comes forward to teach technique, the typical foreman looks at him askance. "What's he know about it? What right has he got to come here and teach me something I've known all my life?" And so on. The reaction is at once one of suspicion and resentment.

But come to the foreman with a program that takes up questions of handling men, of management, of industrial fundamentals, and at once you arouse at least curiosity. After that it is altogether a problem of handling the thing right, of conducting the training in a way that will upbuild the foreman's confidence. The typical foreman, if he has any ambition at all, feels his lack in these directions. He will instantly resent any reflection on his skill as a machinist or a craftsman; but he will be willing to listen to you on a question of how to discipline an unruly workman. The latter is an open question with him, and if he is honest at all he is willing to admit his limitations and welcome light on the subject.

The modern approach to this problem of improving the foremanship seems to proceed on the basis that the prime need of the foreman today is facility in handling men. Efficiency of labor is the secret to efficient production. We talk a lot about the cost of labor turnover, but who knows what the real cost is? Men are lost, new men are hired, and a certain amount of money is spent breaking them in, training them to their new jobs. It is possible perhaps to figure the cost of the employment department, and the cost of the training department. But how can you figure the difference between the old, experienced worker and the new? How can you get down in terms of the adding machine the elements which enter into production by a stable, experienced, competent force, and those that enter into production by a constantly shifting force? Industrial unrest is not always a question of wages, of hours, of unionism. Many a factory turmoil can be traced back to bungling foremanship, many a bitter strike has had its roots in the sharp tongue and offensive attitude of some foreman who was a good technician, perhaps, but a rotten manager of men.

"The friendliest kind of relations between executive and employees, the most careful employment methods, may be wiped out and a high labor turnover piled up by a tyrant foreman," said the general manager of a large Connecticut industry. "The most patient study of operations and the most scientific reorganization of working methods may be entirely wasted by the foreman who tells his men to "fergit it" when the reorganizers are on the other side of the door. The most enlightened and earnest labor policy may be distorted into an object of



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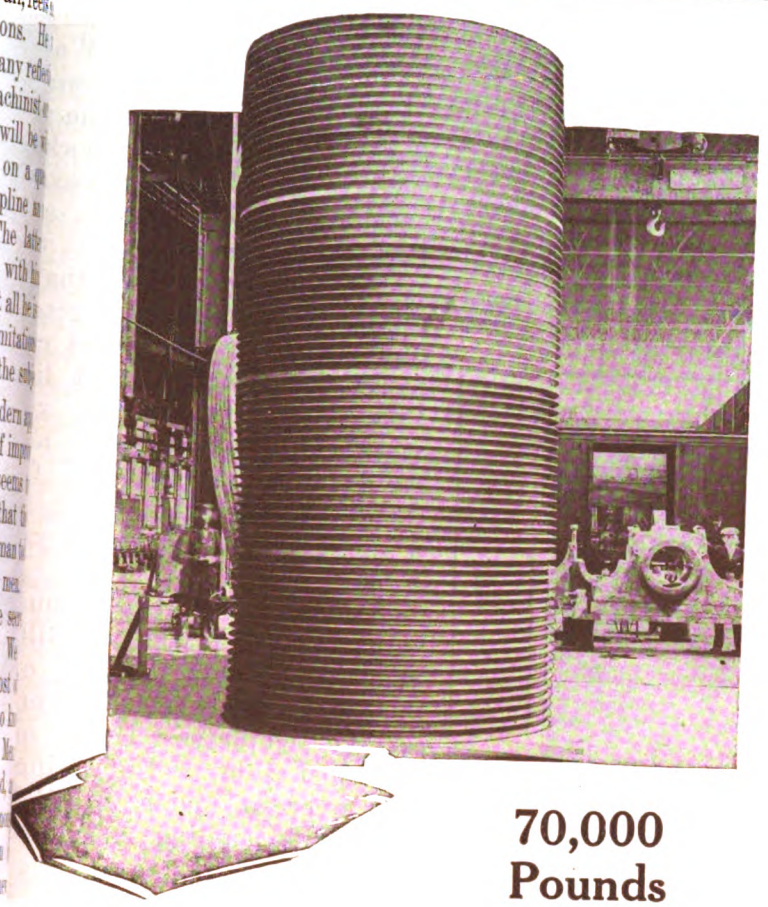
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Similar installations of gigantic power harness have been furnished by Dodge for practically every industry. Rolling mills, paper mills, cement plants, coal and metal mines have relied on Dodge for power transmission equipment for over forty years.

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bitterness and resentment by a few words from a cynical foreman with a grouch.

One solution of the foremanship problem, then, lies this way: To provide stimulation, encouragement, training, enlightenment, to foremen in these directions of their greatest need, rather than to drain off energy and deaden interest by learned dissertations on highly technological subjects.

There is a factory in Illinois which has had some extremely successful results with foremen training, and the superintendent there has described his system as one of "making the foremen into diplomats." The emphasis here is on the foreman's problem of handling the men under him. The training course defines different types—the grouchy workman, the swell head, the over-ambitious, the timid, and so on. Methods of dealing with these different types are illustrated and described. There are examples of how to handle various typical grievances, how to reprimand a man tactfully, how to call his attention to some fault, how to appeal to loyalty, how to win coöperation. It is really a training in applied psychology—though no such forbidding name is used. The superintendent of this factory recently said that foremen training last year doubled the production efficiency of his organization.

Where the foreman so often fails—in his handling of his men—is just the place where he can make his most conspicuous success. Mr. B. M. Nussbaum, the well-known authority on foremen training, was telling recently of an exceptional example of a foreman functioning in a way that would have done credit to the most expert personnel director.

It happened in a Detroit machine shop. The shop was making templates to order on a contract that called for precision work—the templates had to fit to five one-thousandths of an inch. The first deliveries were made, and at once a large batch of the templates were rejected and returned as imperfect. A quiet search was made by the foremen, and the faulty work all traced to one mechanic. It was no time to fire the man, for skilled labor was scarce, the contract was a large one, and the fac-

Points Out Any Shortcomings

in men or machines

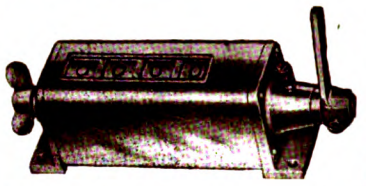
Point at a workman's production-record, or a machine's rate of work:—you will make your point! The record will be improved if it *should* be.

Your presence at the machine isn't demanded. A Veeder Counter will represent you, and get the results *due* you.

In developing production (human or mechanical), what's required of the man and *possible* for the machine may be *HAD* with a

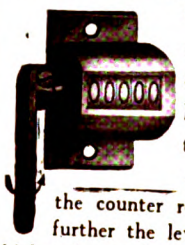
Veeder COUNTER

The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines, where a *reciprocating* movement indicates an operation.



Registers one for each throw of the lever, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $11.50—subject to discount. (*Cut less than ½ size.*) Set-Back *Revolution* Counter of similar model, $10.00 (list.)

This small Rotary Ratchet Counter (No.6) counts reciprocating movements of the lever, as required for recording the output of innumerable small machines. When the lever is moved through an angle of 30 to 60 degrees, the counter registers one. The further the lever is moved, the higher the number registered.



A complete revolution of the lever registers ten. This counter can be adapted to no end of counting purposes, by regulating the throw of the lever. Price, $2.00. (*Cut nearly full size*) Small *Revolution* Counter, also $2.00

This book shows how to count everything automatically. Copy (80 pages) Free.



The Veeder Mfg. Co.

63 Sargeant St., Hartford Conn.

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tory was running at full capacity. The foreman, however, knew his man and believed that it was simply a case of carelessness.

The next morning the foreman stopped at the workman's machine. "Just wanted to see how you get your results, Bill," he said, as he stood by a few moments and quietly watched operations. Of course Bill did his best and turned out perfect templates while the boss was watching. The foreman tried out several of the templates with his micrometer, and smilingly nodded his approval.

Later in the morning the foreman happened up unexpectedly. Bill didn't know he was anywhere around until he was right there, smiling a greeting, and picking up one of the latest templates. He tested it with his micrometer. His face showed amazement. He picked up another one, tried it, and shook his head. "What's up, Bill?" he asked. "These are 'way off. Something's wrong somewhere." Bill looked embarrassed. He had been caught and he knew it. But the foreman took no notice of this. His attention was all for the faulty templates. "Watch this work mighty close, won't you, Bill?" he asked, as he put the micrometer in his pocket. "We're working up to exact specifications on this job, and they check us up close at the other end. Anything that's off the least mite is rejected, and you know what that can mean on a big contract like this. Keep up the lick you were going a while ago, and we'll be all right. And, for goodness sake, Bill, don't let a single one of 'em get by you wrong."

Around noon the foreman paid his third visit to Bill's machine. Again he got out his micrometer, tested several of the templates. Every one was just right. "Not a single one over or under, Bill," he said with smiling enthusiam. Bill grinned.

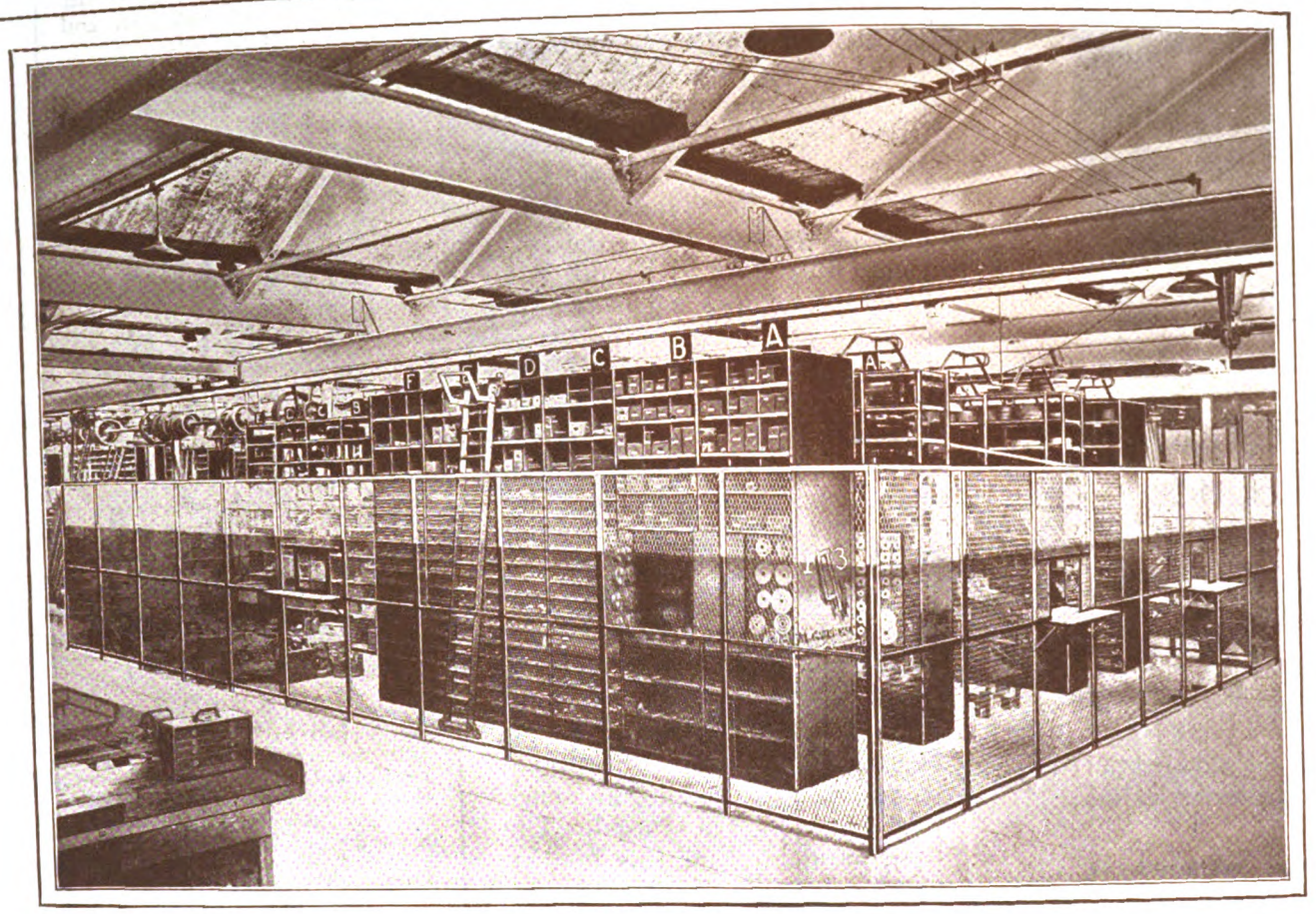
"I knew you could do it, Bill," said the foreman. "Some of 'em wanted me to fire you, but I couldn't lose one of the best men I've got."

Bill's face showed his amazement. "Wanted to fire me! What do you mean?"

"Some of the templates were rejected, and they happened to be a part of your production," answered the foreman. "But I felt sure it was an off day, maybe, or some trouble that was bothering you. For I knew the sort of workman you are, and the kind of work you can turn out. And I've proved I was right, Bill, and mighty glad of it."

That little episode proved to be the redemption of Bill as a workman. Bill's work since then has been of the highest quality, and as for loyalty—nobody could be a stronger adherent of a leader than Bill is for his foreman.

Foremen who can handle situations tactfully and yet firmly are the foremen who can reduce labor turnover, decrease shop loafing, eliminate wastes, and speed up production. All of these things depend to the greatest degree upon the human element in the factory. Wherefore the importance of the foreman who is tactful as well as a tactician, who is a diplomat, who is—if you please—an applied psychologist.



There is Double Economy in Lyon Service

ELEVEN years ago the Landis Machine Company, Waynesboro, Pennsylvania, sent for a Lyon representative to explain the advantages of Lyon Steel Shelving.

After doing so, the representative studied their stores requirements from the standpoints of immediate accessibility of materials — the relation of the stores system to the production and receiving departments — and the probable development of the business.

A complete stores plan was submitted and adopted. It has worked out very satisfactorily.

Since then the Landis Machine Company, one of most modern machine tool plants, has placed with us about thirty orders for Lyon Steel Shelving. These additions to the original installation were made without inconvenience of any sort — due to a well-conceived. well-executed stores plan and to the standardized nature of Lyon Steel Shelving that simplifies expansion of the stores system.

This instance typifies the double economy in Lyon Service. The economy of intelligent planning and the economy of steel shelving of recognized quality.

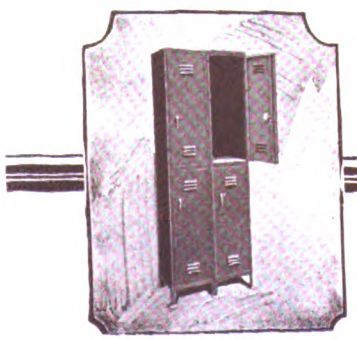
We will be glad to give you full details of Lyon Service and show you evidence of what we have accomplished for other manufacturers—if you will let us know you are interested.

Lyon Metallic Manufacturing Company

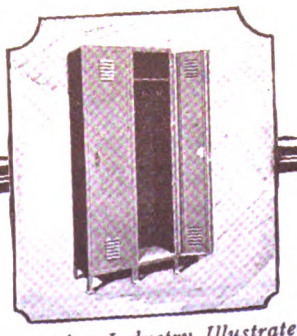
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Plugging the Power Leaks

(Continued from page 18)

life of the equipment greatly increased, if the boilers and auxiliaries were not crowded beyond the limit of their capacity. In such instances the addition of another unit to relieve the overheated plant would be a paying investment and would reduce the excessive wear and tear to a marked degree.

The cost of stoker and grate renewals is invariably increased by the burning of poor and unsuitable grades of coal. High-sulphur coal is particularly objectionable, in that it readily fuses with the small cast-iron parts. In a short time the entire grate area has deteriorated and requires replacement.

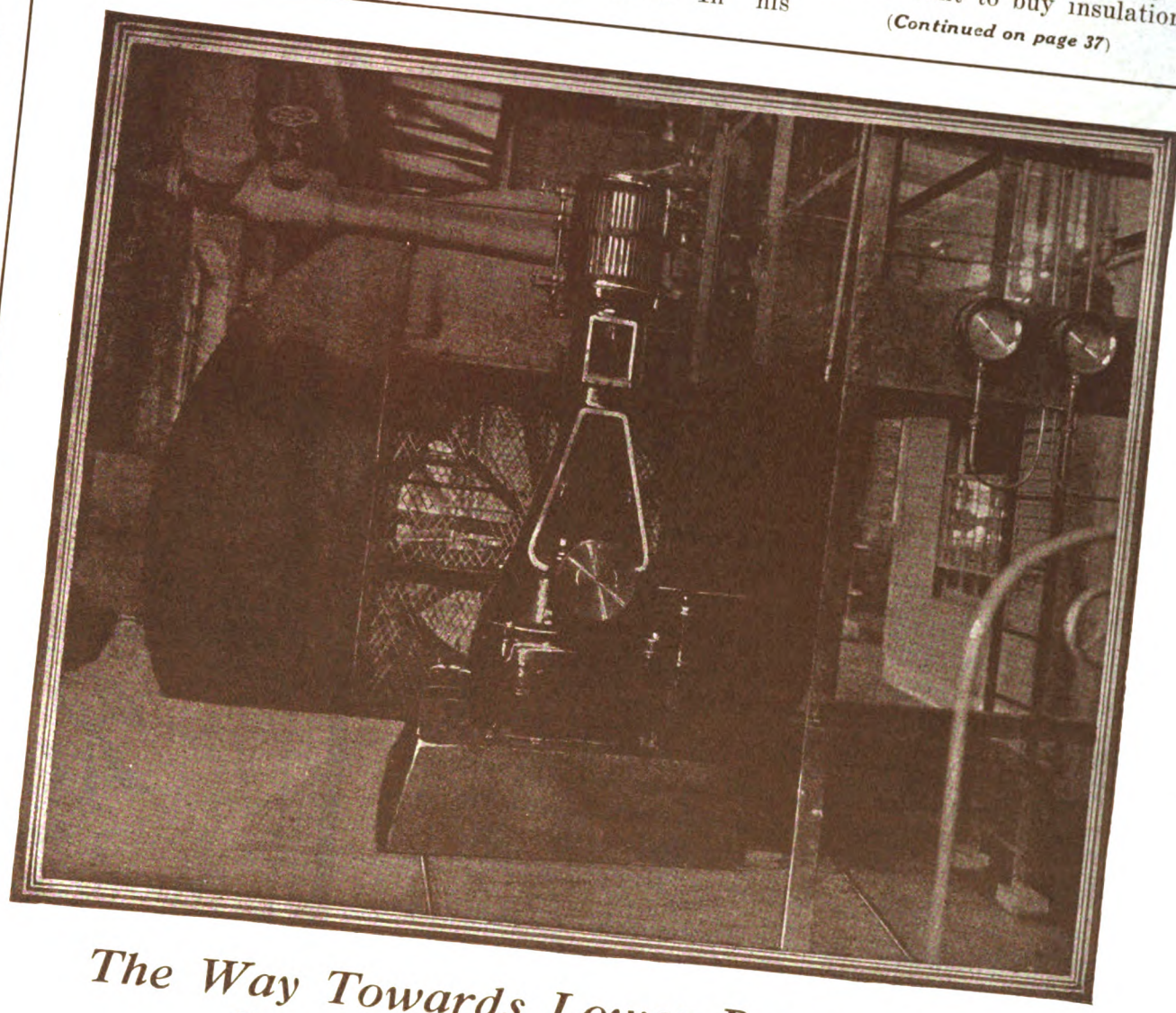
Modern high-temperature brick has made possible material reduction in the maintenance costs of boiler furnaces. It sometimes happens, however, that in forcing the boilers beyond their proper capacity the draft fans are speeded up to a point where furnace pressures are developed. These pressures force the hot gases of combustion into every crack and crevice of the setting, melting the brickwork and often weakening the supporting ironwork. Suitable draft gages for indicating draft and pressures over the fire bed give a visual indication of any tendency for pressure to build up and enable the firemen to avoid the danger point.

When more than one boiler is on the line, each contributes its share of steam in proportion to the heat liberated in their respective furnaces, *i. e.*, in proportion to the condition of their respective fuel beds. Some boilers will, therefore, assume the bulk of the plant load, while the poorly-fired boilers will be "loafing." Boilers developing low capacities are operating uneconomically and are "coal-wasters." When indicating steam flow meters are mounted upon each boiler front the capacity developed by each unit will be visible from the firing floor and the uneconomical boilers can be brought up or cut out of service, as the conditions may warrant.

The importance of heat conservation in the feed water system is often not appreciated and the neglect of this factor results in an appreciable preventable waste. The writer has in mind an amusing incident, which indicated a laudable pride as well as a woeful ignorance on the part of the chief engineer of a certain New England plant.

In this particular plant the brass feed water piping ran from the feed water heater across the boiler fronts, with a branch to each boiler. The chief took particular pride in his boiler house and kept it scrupulously clean. In his spare moments he had polished the brass pipe, which carried several million B. t. u's of good hot feed water, until it looked like "Sunday." He was quite chagrined when we suggested that, if the manager didn't want to buy insulation

(Continued on page 37)



The Way Towards Lower Power Costs Suggests TROY ENGINES

The industrial power plant can be made a profit making department. There is no reason why savings in labor, maintenance and power should be overlooked in the power plant any more than they would be ignored in any of the production departments.

Throughout industry you will find power plants that are run just as efficiently and just as economically in the saving of maintenance costs, fuel costs and steam production costs as are the large central stations. And throughout industry wherever economical and efficient power plants exist, you will find a Troy Engine an important part of the equipment—driving the stokers, fans, blowers or in use as a prime mover.

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Steam Coil
Type SC

This unit distributes warm air evenly throughout any portion of the open area of a building. It can be so connected that it acts as a ventilator and air-conditioner. It uses exhaust or live steam at any pressure—is strictly portable and can be installed by any mechanic. Wherever steam is not available we supply our Direct Fired Type DF, which burns coal, coke, wood, gas or oil.

This Heater Also Ventilates

Here is a real operating economy—the Skinner Bros. (Baetz Patent) *Heater* is also a *ventilator* It actually keeps every part of your building at a comfortable working temperature and at the same time can be used to supply pure fresh air in any quantity desired.

This heater is the pioneer of its type. Its construction is unique—there are no cumbersome outside ducts or pipes used to distribute warmed air. The cost of these fittings is saved—the space they occupy can be used to better advantage.

The heater is very economical—it needs to be operated only a few hours morning and afternoon even during coldest weather. Satisfaction guaranteed.

Read Over These Names of Users

Among the many users of Skinner Bros. (Baetz Patent) heaters are: Ford Motor Co., Detroit Filtration Plant, Lakehurst Naval Hangar, General Motors Co., Federal Foundry, American Stove Co., Maxwell Motors Corp., St. Louis Independent Packing Co., United Paperboard Co., and many others.

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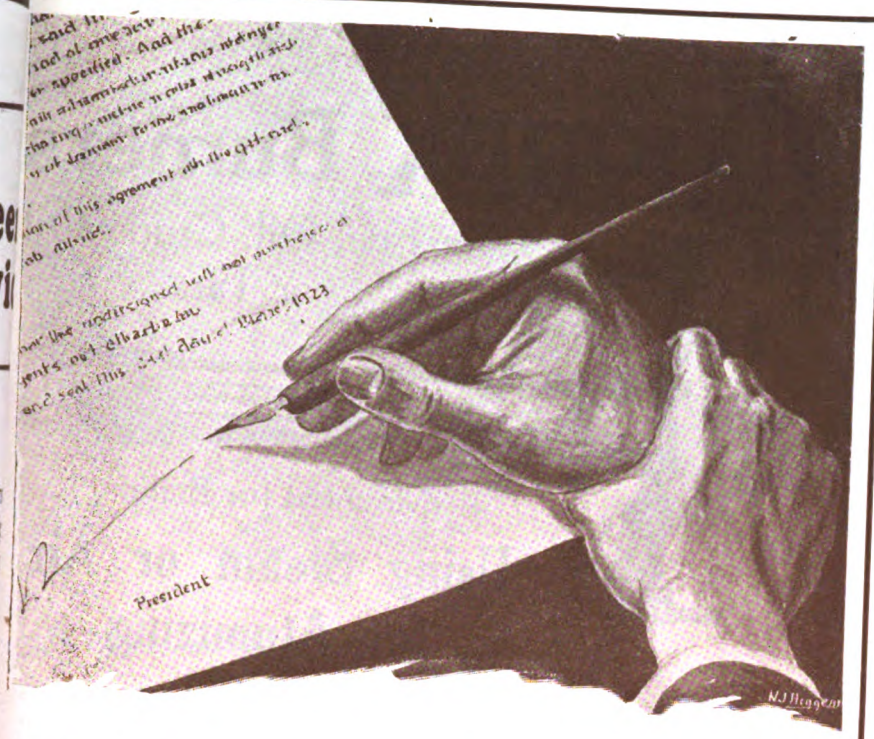
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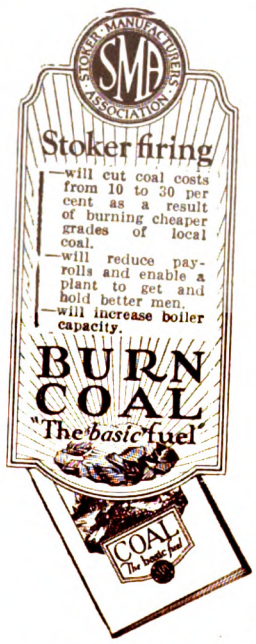


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EIGHT chances out of ten you are not buying the cheapest fuel that will operate your plant satisfactorily. And, just as likely, you are buying at least ten per cent more coal than you would need if your plant were scientifically fired by full fledged mechanical stokers. Is a saving of ten to twenty-five per cent of one of your largest items of operating cost worth careful consideration?

The Country's most prominent combustion engineers are ready to show you which fuel you should burn and how you should burn it. You can have this counsel without cost or obligation by referring your entire combustion problem to the capable engineering staffs of the well-established manufacturers of mechanical stokers.

If you want to save coal and labor, and in doing it have a smokeless stack in the bargain, investigate the possibilities of scientific combustion. Do it before you pay another coal bill or sign another coal contract. The informative book, "Coal—The Basic Fuel," will give you a good idea of the scope of scientific combustion.



Read why you should burn coal and how you should burn it.

Stoker Manufacturers Association

Mr. G. A. SACCHI, Secretary Stoker Mnfr's Ass'n

Lester Branch, Philadelphia

(Continued from page 35)

for the feed water lines, the next best thing would probably be a good healthy layer of dirt. But bright, shiny brass made about as good a radiator of heat as anything we could think of on the spur of the moment. It nearly broke the chief's heart when he covered that feed line with insulation, but it must have saved some coal.

Automatic feed water regulators render valuable assistance in maintaining continuous steaming and high economy in boiler operation.

With hand feeding, large volumes of relatively cool water are suddenly introduced into the hotter boiler in a short period of time. The result is that the boiler suddenly stops making steam for the time being. The inefficiency of this method multiplied by the many times this operation is performed daily results in another loss which is appreciable over a period of time. Some stations have found that automatic feed water regulators also reduce boiler room labor costs, in that it is possible to release one or two water tenders for other duties.

The necessity for blowing down boilers at frequent intervals, due to the use of bad feed water, causes losses that are sometimes unnecessarily large. When it is not possible to remove harmful impurities from the boiler feed before it enters the boilers, these losses may be minimized by opening the blowoff valves no oftener and no longer than is absolutely necessary.

No accurate knowledge of the location and magnitude of boiler room operating losses can be had without suitable indicating, recording or integrating instruments. Without such knowledge continuous and permanent economies are difficult, if not impossible, to attain. Proper instruments are as necessary, therefore, to the plant engineer as are the clinical thermometer and stethescope to the physician. They furnish the information, which, if intelligently interpretated, will assist in diagnosing the operating ailments and in prescribing the proper remedy.

One of the most common and most wasteful features in the distribution of steam through-

(Continued on page 39)

Eliminating

"I guess"
"I believe"
"I suppose"

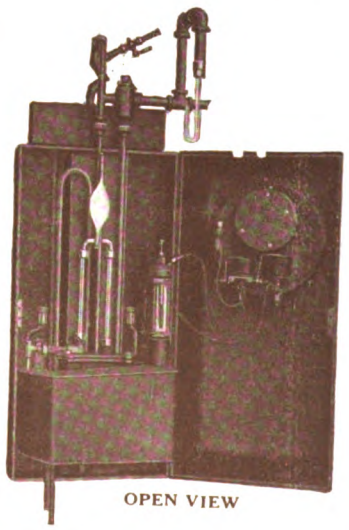
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Put your firemen in a position to know what to do and how and when to do it. It will mean far greater efficiency in the boiler room and save you money. Don't force the firemen to go by "guesswork". A daily chart from the Hays Automatic Co_2 & Draft Recorder will supply the information at the time it is needed.

The Hays Automatic Co_2 & Draft Recorder (Model B) is the last word in being the most practical and simple in construction and operation. Any ordinary unskilled laborer can operate it. The Standard recorder will chart the percentage of CO_2 contained in the waste gases from the boiler furnaces, stills, kilns and also the draft over the fire. The standard range is O —20% CO_2 and O—1 inch water draft. Attachment can be provided for Double Draft Record to show draft loss through tubes as well as draft over fire and in last pass.

Special recorders are furnished for SO_2 or other acid gases and CO_2 recorders of any range other than O—20% on short notice.

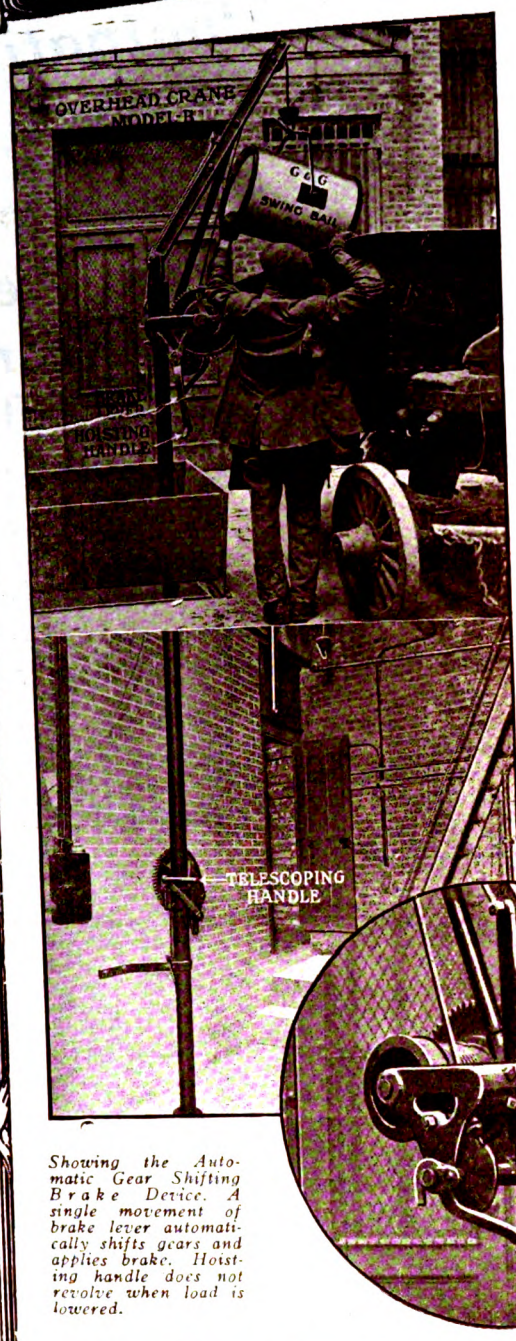


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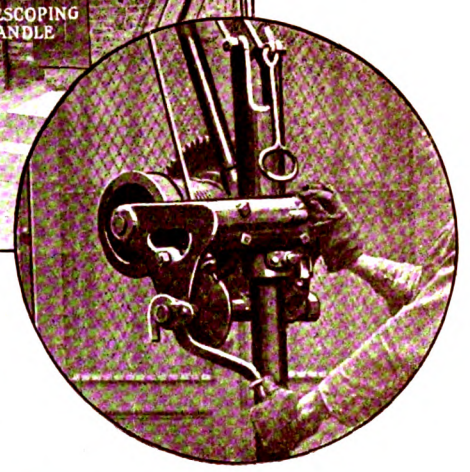
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Model B Hoist at W. W. Astor Bldg., 323 Fifth Ave., New York City; John F. Burrow, Architect. Can is emptied into wagon without rehandling at grade level.



Showing the Automatic Gear Shifting Brake Device. A single movement of brake lever automatically shifts gears and applies brake. Hoisting handle does not revolve when load is lowered.

Simple to Operate Little Effort Required

THE Model B G&G Telescopic Hoist raises load by hand power and lowers by gravity. To raise average filled can of ashes requires only a pressure of 12¼ lbs; on hoisting handle. In lowering, just enough pressure on brake handle is needed to check descent. Complete G&G ash removing equipment as illustrated includes Hoist, Sidewalk Doors, Spring Guard Gate, Door Opening and Closing Device, Operator's Ladder, Swing Bail Ash Cans, and Ash Can Truck.

If you will tell us what loads you are handling, our Engineering Department will be glad to recommend the model best suited to your individual requirements.

Write for booklet "Industrial Plants Need this Hoist."

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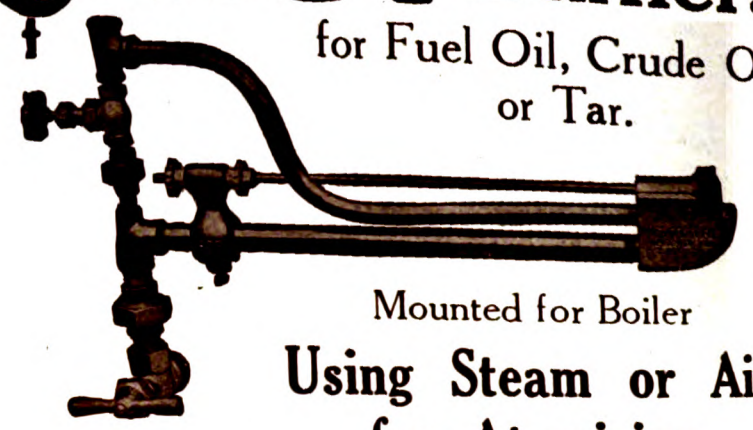
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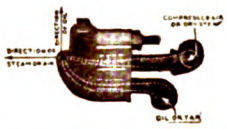
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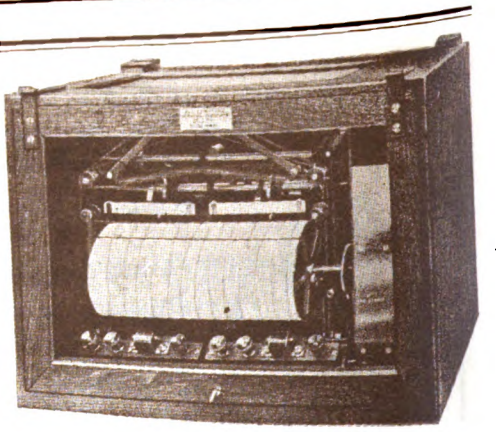
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Save time by having a continuous record of boiler performance right in front of the operator.
They are entirely electrical—no chemicals to renew—no glass or rubber parts to break or wear out. Can be installed any distance from the flue. As accurate as an Orsat with none of its faults or maintenance troubles.
Other Cambridge instruments—Electrical Distance Thermometers. Thermo-electric Pyrometers, Optical Pyrometers, Draft Gauges.
Send for List 157 X.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC.)

MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK — INCORPORATING CHAS. F. HINDLE — SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

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Answering the forced draft problems of every industry

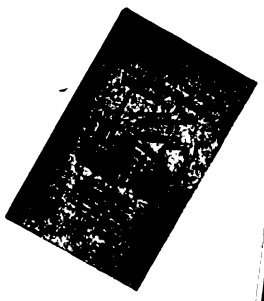
Every industry has different conditions to meet, different problems to contend with and Clarage Engineers have an answer to Every one.

Here six giant Clarage blowers are working in the plant of the Mac Sim Bar Paper Company at Otsego, Michigan. This is one of the many different installations of Clarage Blowers in every part of the country, and but one of the many kinds of work they are doing.

They are serving in the steel plant, the manufacturing plant, on railways, everywhere that forced draft is required. They are moving light materials, drawing off dust, supplying fresh air, removing condensation, exhausting paint fumes and doing countless other jobs at low cost. Engineers have found that they are solving the problem of economy, answering the demand for constant, faultless service and increasing plant efficiency in every installation.

Send for the booklet on moving air. It will tell the whole story.

Offices in principal cities.



CLARAGE
FAN COMPANY
FANS—BLOWERS—EXHAUSTERS
KALAMAZOO

built in types and sizes for every service.

(Continued from page 37)

out the average industrial plant is the bare steam line. Some day, when you are out in the plant, pick out the steam lines. How many are covered; how many, partly covered; and how many, with no insulation at all? Many plants are satisfied with insulating everything except flanges, valves and fittings. Count up the number of uncovered flanges and fittings in your plant. Multiply them by one and you will have the number of tons of coal they are costing you every year.

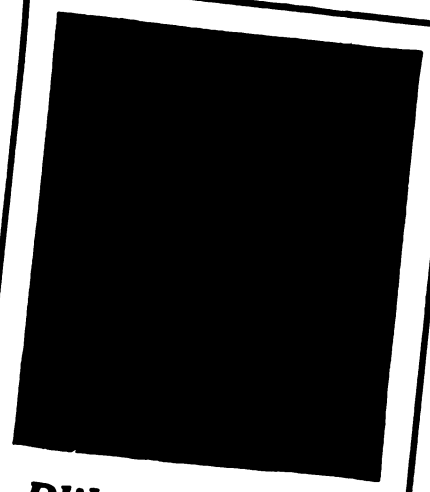
It is common practice in the layout of industrial plants to run steam lines haphazard and to cut in with branch tees wherever they are needed. The result is that the pressure drop between the departments where the steam is used and the boiler house where it is made gradually become larger as the plant grows in size. The line and condensation losses increase. Fortunate, indeed, is the plant with a Master Mechanic whose vision carries him beyond today into tomorrow and who plans his piping to meet the future growth of the plant.

In many cases poorly designed steam lines cause excessive vibration. This is especially the case in main steam lines where large volumes of steam traveling at high velocities, must make sharp right-angled turns. Such vibrations cause a gradual weakening of the joints and of the pipe supports and result in unnecessary maintenance and repair costs. Sometimes the installation of a large receiver reservoir in the steam line will act as a cushion to absorb the vibration and nullify the ill effects that would otherwise be produced.

Compared with the boiler house, the engine room is an economical and efficient department. It usually has the benefit of closer supervision on the part of the engineer. It is clean and offers more in the way of comfort and convenience than does the boiler house.

Where the equipment is old, however, there is apt to be considerable steam loss due to poor condition of steam engine valves and improper setting. Worn piston rings and scored cylinders cause a further loss of power.

Where the supply of exhaust



Plibrico eliminates this!

WHEN furnaces are lined with fire brick, it is not long before the flame attacks the joints, causing the bricks to crack and spall. Soon they crumble and fall out, and the entire lining goes bad and allows heat to escape—just like the lining in the photo above.

Plibrico Furnace Lining eliminates this. Plibrico is pounded into place while plastic, and forms a jointless lining—a lining that lasts two to four times longer than fire brick, that resists heat to 3100 deg. F., and that cuts down heat radiation. It is ideal for ignition, front door and rear combustion arches and special shapes because it can be applied to any shape. Unskilled labor installs it—with mallet and trowel.

Plibrico is delivered only in steel containers of distinctive appearance as shown below. **Warehouse stocks in over sixty cities in the United States and Canada: see phone books.**

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FURNACE LINING
JOINTLESS FIRE BRICK CO.
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Book Free

Ask for the 50 page "Modern Furnace Building." It will point the way to lower furnace costs—and greater profits.



Jointless Fire Brick Co., 1154 Clay St. Chicago.

Please send me the 50-page booklet, "Modern Furnace Building"—no obligation.

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Ind. Ill. 9-23

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steam exceeds the needs of the plant for heating and other purposes, the need for engine room economy is important. Indicator cards taken at regular intervals give a reliable check on the economy and performance of the engine.

In the various plant departments there are many opportunities for steam losses, due largely to the lack of familiarity of the operators with steam engineering principles. Properly designed traps are one of the greatest aids to steam conservation, provided they are of ample capacity, correctly installed, regularly inspected and properly handled. If practical, it should not be permissible for foremen or operators in the production department to tamper with them. The duty of trap inspection and repair should be delegated to one or two men who are thoroughly familiar with their proper operation. In the case of a large manufacturing concern in Pennsylvania, it was possible to cut coal costs nearly 15 per cent. by proper operation and responsible inspection of the steam traps.

There are many cases where live steam is used for drying where exhaust steam would serve the purpose just as well. Live steam is expensive and its use in such cases is a total loss. Exhaust steam, which has already passed through the engines and has rendered its return in the generation of power, is a by-product. Any further use that can be made of it represents a saving and the plugging of another leak.

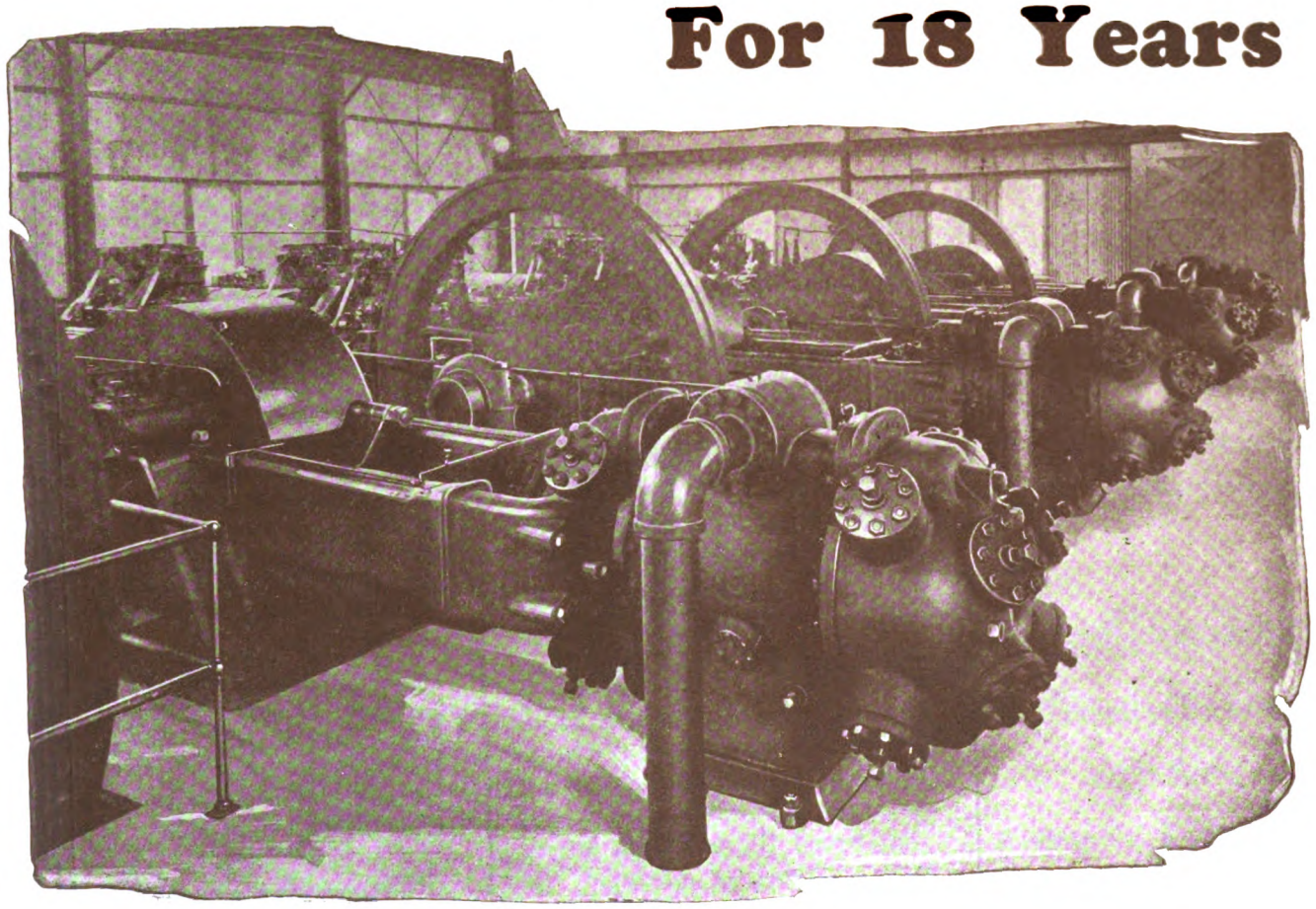
One of the chief uses for exhaust steam in industrial plants is in the heating of the buildings in the winter. Unless these heating systems are correctly designed, however, an excess amount of exhaust will be required, there will be less surplus for the process work and expensive live steam will have to be used to fill the deficiency. Strange to say it is not uncommon to see heating coils running along the upper part of a wall. They might just as well be on the outside of the building. The exhaust steam used heats the roof and the floor stays cold. The wasted steam could probably be put to a profitable use elsewhere in the plant.

In some plants a supply of waste hot water is available. The addition of a circulating pump often makes it possible to use this water in a forced hot water circulation system of heating, thereby reserving the exhaust steam supply solely for process work and, perhaps, eliminating the need for live steam at all.

In every heating system clean radiating surfaces are essential to economy. Dirty surfaces insulate heat. Where exhaust steam is used, therefore, separators of adequate size are necessary to remove any lubricating oil that may be carried in suspension in the steam as it comes from the engine cylinders. Otherwise the metal surfaces become coated with an oily deposit and the efficiency of the heater is reduced. The piping in the average industrial plant consists of a maze of valves, elbows, tees and nipples. If the foreman in Department "T" wants a vacuum pump a new branch is cut into the already

(Continued on page 42)

Worthington Gas Engine Has Run For 18 Years



In 1905 a Worthington gas engine was installed in the Folsom, West Virginia, plant of the South Penn. Oil Co. There is nothing spectacular about this part of the story but—at this date, after eighteen years' regular service this same engine is running, and the fact that it still has all four of the original cylinders is evidence of careful design, fine workmanship and the selection of the best materials used in its construction.

WORTHINGTON PUMP AND MACHINERY CORPORATION

Executive Offices: 115 Broadway, New York City. Branch Offices in 24 Large Cities

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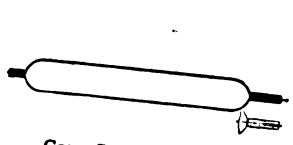
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Cross-Section Showing Hollow Construction



SEAMLESS DRAWN STEEL HOLLOW ROLLS

For Conveying Systems, Steel Mill Tables etc.

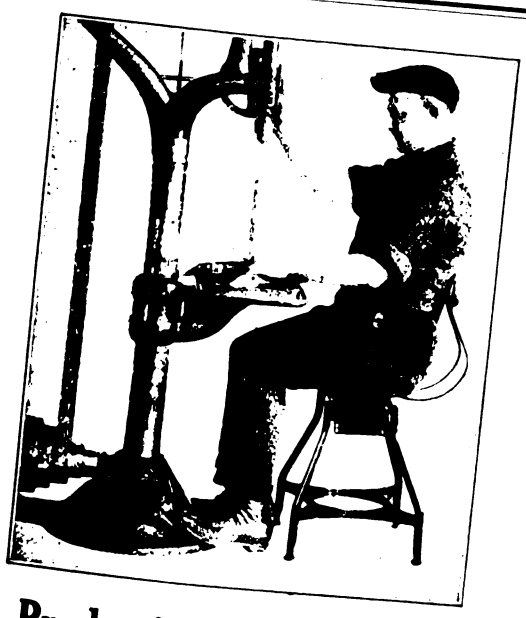
Because these rolls are light in weight they possess these specific virtues:

There is a saving in freight
They are easy to handle
Operating and power costs are reduced

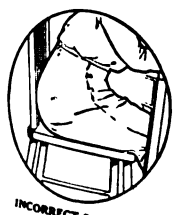
Built only on order to meet customers requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.

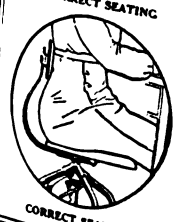
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(Founded 1859)
30 Church Street, New York, U. S. A.
Cable address—Wilwharton



Increase Production with "PosturChairs"



INCORRECT SEATING



CORRECT SEATING

Employees' health and efforts depend to a great extent upon correct seating. They can't put forth their best in chairs that cause fatigue and muscular strain. Recognition of this fact on the part of executives has created a nation-wide demand for Uhl Steel "PosturChairs."

These new chairs of steel were scientifically designed to promote health and comfort and prevent fatigue—the thief of production. You sit in a "PosturChair"—not on it. The seat is shaped so that the body weight is properly distributed over the pelvic seat bones and thighs, and does not rest entirely on the pelvic bones as with other chairs. The low adjustable back forms a firm support for the spine just where support is needed. The body is held upright, comfortable. Vital body organs are allowed to function normally. The "PosturChair" keeps one feeling his best and working his best. The day is shortened; results are lengthened. It is the only steel factory and office chair which has the approval of the American Posture League, a national organization working for better employee health and efficiency.

Let us send you one for a trial in your factory, so you can test it under your own conditions, along side of any other chair made. If you don't think it means better work and more work, let us know and we will take it off your hands. Write today.

The Toledo Metal Furniture Co.
1616 Hastings St. Toledo, Ohio
Manufacturers of Uhl
Steel Furniture, Typewriter Desks, Chairs, Tables, Stands, Vault Trucks and Factory Equipment.



Glow-Brite

A Liquid Cleaner for Factory Glass

Cleans Factory Glass regardless of dirt, grime, carbon or rust, scale, without injury to paint, putty or sash.

Wet surface to be cleaned with GLOW-BRITE, then flush with water, no rubbing or scrubbing.

Leading Steel Mills, Foundries, Machine Shops, etc., use it everywhere.

5 Gallons easily cleans 4500 Sq. Ft.
6000 Sq. Ft. cleaned a day by unskilled labor.

It costs less per Square Foot to clean with GLOW-BRITE, because it costs less per Gallon.

GLOW-BRITE COMPANY

1006 Rockefeller Bldg.
Cleveland, Ohio

TRIAL OFFER

Clean 1800 Sq. Ft. at our expense before you buy it, and prove for yourself it is all we guarantee it.
Write us before you start your Fall Cleaning and state number Square Feet to clean.
Exclusive Manufacturers Liquid Factory Glass Cleaner.

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ELWELL-PARKER



HAND OR ELECTRIC TRUCKING?

Time has nearly passed for choosing.

ELWELL-PARKER

Electric Industrial Trucks and Tractors

are available now

but common labor is not

ELWELL-PARKERS

lift, carry, and place the loads where wanted.

They will deliver eight times the load at three times the speed of a hand trucker.

They are always ready, work early and l e. Many operate 23 hours per day.

60% of all handling can be done by these units. May be driven practically any place a hand truck can be pushed.

Thousands in operation in over 200 branches of industry in 23 different countries. Tried and proven equal to every inside haulage requirement. Many have been in continuous service for over 10 years.

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trucks are guaranteed to save from the very start.

SELF-LOADING TRUCKS
DUMPING TRUCKS
CRANE TRUCKS
LIFT TRUCKS
TRACTORS

Our unobligating survey is yours on request, or ask for Bulletin 51.

ELWELL - PARKER

ELECTRIC COMPANY,

CLEVELAND



(Continued from page 40)

overloaded steam line and a steam-driven unit is installed. If Department "T" is an appreciable distance from the boiler house, the pressure drop and condensation losses make such an arrangement very inefficient. Considering also the greater economy possible from the large main units in the engine room, as compared with small, independent units scattered through the plant, motor drives are in many cases more economical than steam units.

Perhaps the most common use for exhaust steam in industrial power plants is for the heating of the feed water before it is introduced into the boilers. Here again clean heating surfaces are essential, requiring the installation of an oil separator in the exhaust line between the heater and the engine. Proper insulation reduces radiation loss and assures a more efficient transfer of the heat from the steam to the water passing through the heater. Recording feed water thermometers installed in the feed line between the heater and the boilers indicate the cleanliness of the heating surfaces and the efficiency of the heater.

The capacity of the heater is an important factor. There must be sufficient heating surface exposed to the hot steam so that the water will absorb the maximum amount of heat before it leaves the heater. When the heater is too small the exhaust steam passes through it without giving up its heat and the resultant loss in economy is considerable.

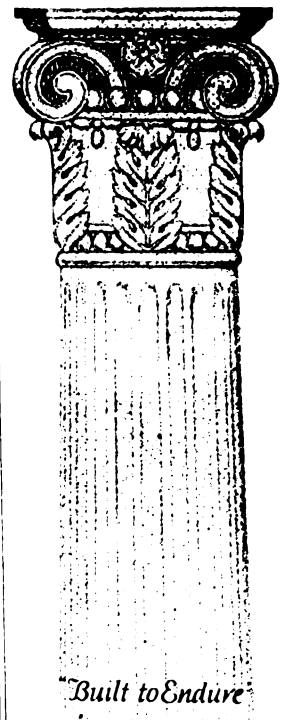
In the matter of attaining and maintaining steam power economy in industrial plants, the boiler house usually offers the largest field for immediate returns on the time and effort spent. Most of the coal is wasted there. It is not unreasonable to state that it is possible in almost any industrial plant to realize a saving of at least 10 per cent. of the power cost by effecting common-sense economies in the boiler house alone. In the average plant as high as 20, or even 25 per cent. are possible.

A Pillar of Strength

PERMANENT as the Corinthian pillars of old, are the files of those concerns that have wisely chosen Globe-Wernicke Steel Upright Filing Equipment. They are built by an organization with years of experience behind them, to give perfect service during the lifetime of any business.

Globe-Wernicke Steel Files are welded into a complete steel shell. The newly perfected slides work smoothly and noiselessly, and will not wear even when the drawer is filled to the maximum load.

The beautiful enameled finish adds that tone of refinement to any office which favorably impresses everyone.



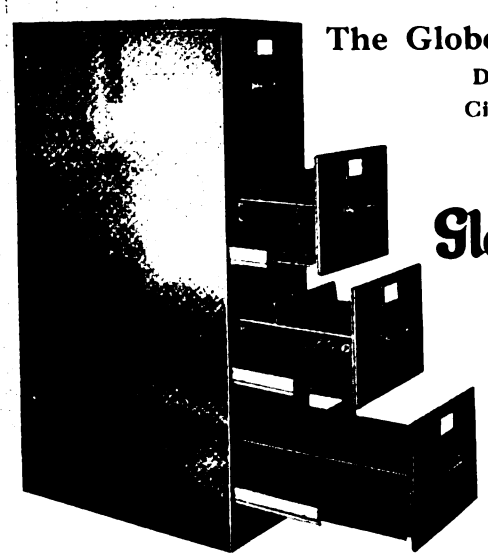
All the hardware is solid brass and the perfect follower block, independent of rod, glides smoothly at all times and clamps the papers tightly in an upright position.

Big Business is now standardizing on Globe-Wernicke Filing Equipment.

This particular cabinet is No. 7141

Built to Endure

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Berloy Shelving systems are keeping stock of The Westinghouse Electric Co. in a systematic and economical manner.

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Berloy Steel Shelving systems insure an accurate perpetual record of income, outgo and balance on hand. Stocks represent money. They should be systematically handled.

Berloy Shelving is quickly and easily adjustable to meet changing conditions. It can not wear out.

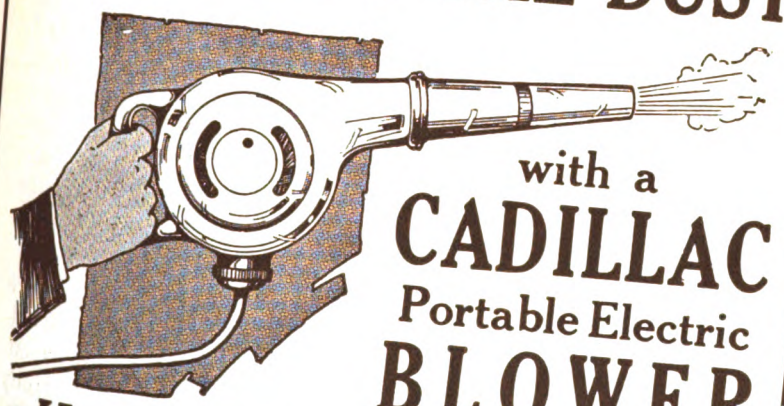
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BLOW OUT THE DUST



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CADILLAC Portable Electric BLOWER

Keeps Machinery Clean

The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc. Complete in itself and requires no expensive installation or equipment.

Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories and every line of industry.

Write for descriptive folder giving prices and testimonials by leading manufacturers.

CLEMENTS MFG. CO.
Manufacturers of the Cadillac Electric Vacuum Cleaner
612 Fulton Street CHICAGO
Canadian Factory: 76 Duchess St., Toronto



Cleaning small motors. No condensation to short circuit motor and no excessive pressure to injure windings or insulation.



LAY

High up among the steel girders and temporary platforms of the new Wrigley building of Chicago —sister structure of the world-famous building shown—Lay Metal Case Brooms are each day clearing away chipped tiling, chunks of lumber, plaster and loose dirt—matching in their steady, trustworthy performance, their actual elevation in position.

A Policy of Specialization

When Joseph Lay made brooms by hand back in the seventies he soon realized that the requirements of the different industries demanded different broom construction. He originated the policy of perfecting a special broom for each particular industry. He built a broom to do the job as it should be done—as would have it done.

This policy and standard is still maintained by THE JOSEPH LAY COMPANY. No matter what your sweeping need is, nor what your line of manufacture, our forty-four years of experience has perfected a particular broom to serve you best and longest.

Try a dozen of our selection. Each one is fully guaranteed. What better assurance can we give of quality?

Satisfied Users of Lay Metal Case Brooms

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And more than 4000 other industrials.

Get LAY METAL CASE BROOMS for *your* particular job.

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120 College Street
Ridgeville, Indiana

Originators of the Metal Case Broom

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Developing the Full Capacities of the Factory Tractor

(*Continued from page 25*)

States, or from European or Asiatic countries. In fact, a number of concerns in the New York district have recently been employing a number of Orientals, and a raid on the manufacturing plants in Brooklyn, netted quite a round-up of Chinese labor that had been smuggled into the country.

Why do our business men go to such extremes in abetting in the flouting of the laws of the land, when they can, by simply investigating, find means of applying mechanical equipment to their common labor problems.

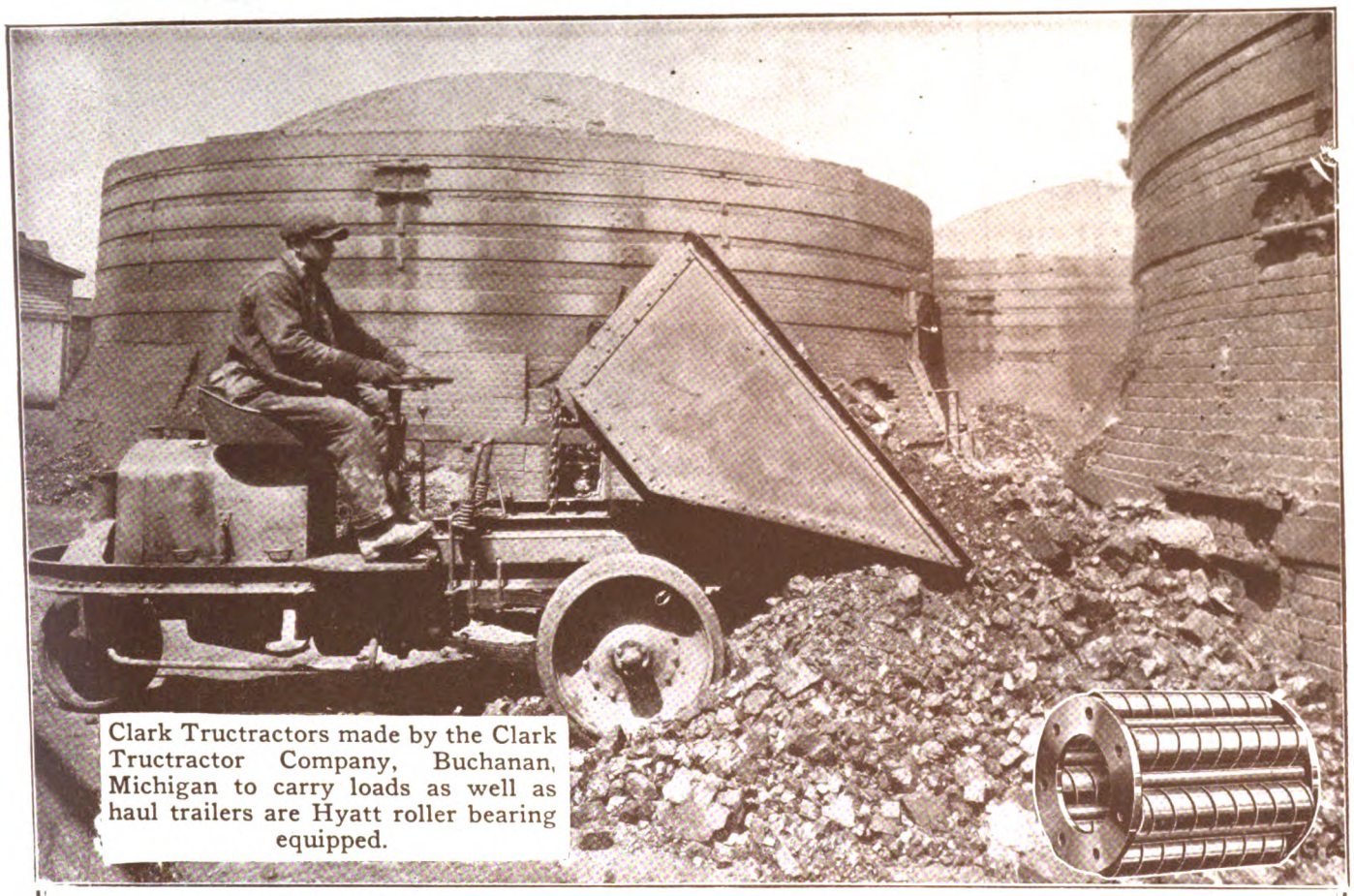
While tractors and trailers are dealt with in this particular article, other articles appearing in this publication have shown how to use various types of conveyors and elevators, in case the material to be handled is in bulk, and also conveyors have been shown for handling package goods. The American industrial tractor of either electric or gasoline drive, given the proper application, is the greatest labor conserver in the industrial vehicle family. Assuming 10 tons as a tractor load, a single machine replaces 40 hand truckers, handling 500 pounds each. By proper routing with a drop and pick-up system, of trailer trains, a tractor can be kept almost constantly in action under load.

The shrewd executive, seeking economic or cheap labor, can adopt no better tactics than to work out a way to apply tractors and trailers to his material handling problems. Haulage is the backbone of virtually every industry. Unless raw materials, parts, finished products, supplies and freight move smoothly, and on time to the point of need, the whole operating schedule breaks down with an expensive waste due to labor time, idle equipment, and all the far-reaching effects resulting from an upset of routine. The man on the hand or push truck, and the gang carrying a load by hand, whether in industrial plant, storage yard, warehouse, freight platform, passenger terminal or pier shed, are heavy penalties on profits. Power does the job more cheaply.

In spite of this truth, there are still thousands of individual companies whose executives extravagantly employ man power for the internal handling of incoming and outgoing freight, raw materials, parts and finished products. In addition to wasting needed man power, these companies, almost without exception, are showing too high operating costs, and too narrow profit margins.

Most of the advantages obtained by the use of a tractor trailer system of industrial transportation, when compared to manual handling, are:

1. Reduced number of men on the payroll. Cheap operating costs.



Clark Tructractors made by the Clark Tructractor Company, Buchanan, Michigan to carry loads as well as haul trailers are Hyatt roller bearing equipped.

Bumping—Banging—Jolting Along

Over cobble stones, up curbs and down, across rough lots, quickly and dependably carrying their loads-all in the day's work for Hyatt equipped Clark Tructractors.

An important factor in the capable handling of loads under severest conditions is the stamina of Hyatt roller bearings. Day in and day out they produce their easy rolling motion and with no attention except lubrication three or four times a year will last throughout the life of a tractor, without adjustment or replacement.

And in trailers Hyatt bearings are just as valuable—they enable tractors to pull twice as many trailers without battery strains or noon-day boosting.

For dependable and economical haulage equipment specify that your tractors and trailers be Hyatt equipped.

Hyatt Roller Bearing Co.

Newark Detroit Chicago San Francisco

Worcester Milwaukee Huntington Minneapolis Philadelphia
Cleveland Pittsburgh Buffalo Indianapolis

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ELEVEYOR



Combines the Functions of 3 Trucks in 1

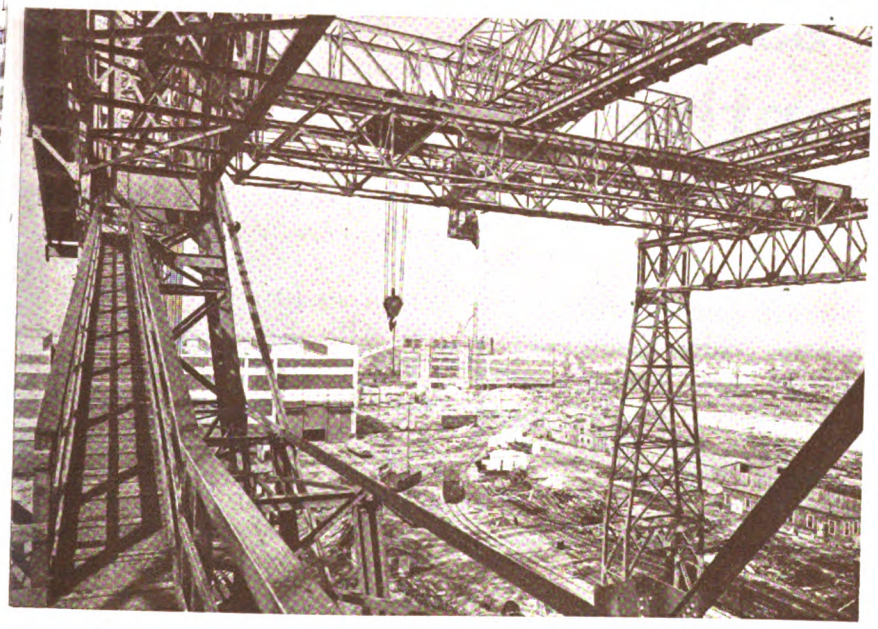


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The ELEVEYOR combines the advantages of three different trucks in one. It is a low platform type; likewise, a low elevating type for conveying loading platforms; also a high elevating type for stacking. Get our new catalog.

ELEVEYOR INDUSTRIAL TRUCK CORP.
56 Huntington Street Brooklyn, N. Y.

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Save time—Save labor—Save space with modern crane equipment

The shipyard owner often finds it convenient to build a runway structure that will carry several cranes of different spanes and capacities. Such an installation is shown here. The service demanded is severe. Never sheltered from the elements, such cranes are frequently on duly twenty-four hours a day.

Niles Cranes are the logical choice for such service because of their rugged reliability. They can be furnished in capacities to handle a winch or the main engines with equal ease as occasion may require. We build them up to 250 tons.

Tell us your crane needs.

For the Steel Mill Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy materials must be handled with speed, safety and economy.

NILES-BEMENT-POND CO.
111 BROADWAY—NEW YORK CITY
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No. 5 *of a series illustrating the many industries served by Niles Cranes.*

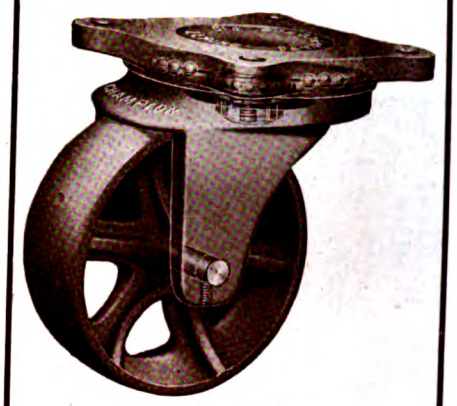
3. Quicker and better deliveries of materials between operations.
4. Complete co-operation between departments.
5. Increased production.
6. Reduction of labor troubles.
7. Reduction of labor turnover.
8. Reduction in amount of materials and parts damaged in transfer-from operation to operation.
9. Better working conditions.
10. There are numerous others, such as assisting in distributing all costs of handling between departments, instead of placing it as an overhead item, providing a means of checking up the weak spots in the organization, etc.

The number of advantages depends upon the amount of attention paid to the system, and the human element which operates it. By this I mean, that if the system is operated with a common laborer as its directing head, the results will not be as gratifying as if an intelligent and able man were placed in charge.

The writer has often analyzed the transportation problems of plants, with a view to improving the present handling of materials, and often it has been recommended that a tractor trailer system be installed. If no equipment but common stevedore hand trucks are being used in the plant, it frequently necessitates the purchase of considerable new equipment. Many times the recommendation has been turned down because the executive did not know what it was costing him to handle materials with his present equipment, and he did not take sufficient interest in it to have his own force find out the cost, or permit an outsider to determine it for him. In other instances, the present costs have been determined, but the initial investment has appeared too large, and the difficulty of obtaining such a large appropriation has deferred the installation of the system. It is now my practice, and I strongly recommend this method of procedure to salesmen and executives, to take

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In the Champion Adjustable Double Race Caster, both races are in contact; there is no friction on stem, insuring equal distribution of weight and wear; the friction and strain are relieved from all directions; it is not affected by side thrusts.

Champion Casters pay for themselves in time saved because of the adjustment.

When ball races become worn, it is only necessary to adjust the nut in center of fork; you need not pull truck apart or buy new casters. Every adjustment of the Champion is the equivalent of a new Caster.

The wheel shaft assembly is also an advanced step.

There are no projecting bolt heads, nuts or cotter pins.

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Please send Caster Bulletin telling about the new Champion Double Race Casters.
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one step of the problem at a time, and segregate it, so that after its successful solution, it will be possible to take the next step without having to alter the first. This method necessitates making a complete study of the problem, and laying down a definite program, but gradual development will always prove the soundness of the complete system.

The installation at the Minneapolis Steel and Machinery Co., at Minneapolis, Minn., shown in figure 20, was installed in this manner. It was found that the old method of horse and wagon intra-plant transportation, the cost of handling materials was $1.50 per ton, and it required 47 men, plus 14 teams and wagons to perform the operation, which was none too good. In 1917, the company investigated, and started to install a tractor trailer system of transportation. In 1919, the installation had been completed, and it was found that 14 men, 3 storage battery tractors, 53 small trailers, four 4-ton trailers, and 2 2½-ton capacity trailers, a motor ruck, popularly known as "jitney" and power lift transfer trucks which handle materials in the shop, could handle all the company's materials. The cost had been reduced to 30¢ per ton, and from 50 to 100 per cent. more tonnage was handled by the new equipment. This saving of $1.20 per ton handled, makes an aggregate saving of $200 per day in handling costs alone. It did not take many days' operation to pay for the installation.

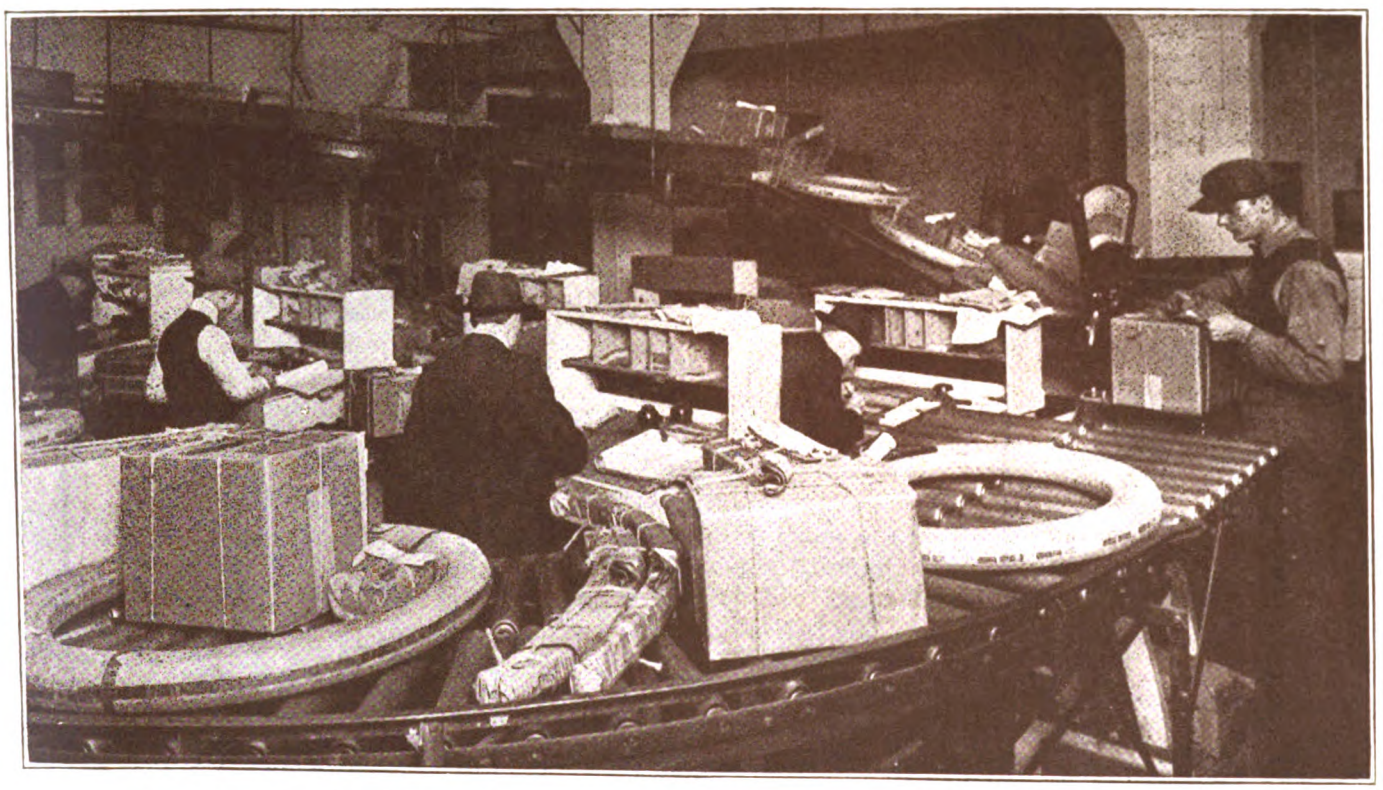
There are few industries to which the tractor trailer system cannot be applied. Figure 6 shows a gasoline tractor operating in the plant of one of the largest metal works in the country, and this installation of material handling equipment has been found very successful. Figure 11 shows an electric tractor handling refuse in the narrow aisles of stock yards. This has always been a very serious problem, because large vehicles could not negotiate the short turns. Note how the trailer train is making an "S" curve. The tractor can just be seen in the center of the picture. There are at least 12, if not more, trailers in the train. This installation has made large money savings.

Figure 13 shows another long train of trailers being handled in the cooperage plant of a large oil company. While the type of runway shown is not highly recommended, the tractor trailer train will operate over it, but the maintenance costs will be slightly higher than if concrete runways were installed. Of course in this case, where the face of the pile is continually shifting, it is necessary to move the runway with it.

The secret of economical operation is heavy loads. Figure 12 shows an electric tractor handling approximately 6 tons of material on four trailers. For this reason, considerable attention should be paid to the trailing equipment, so as to get the most efficient operation. Figure 5 shows an excellent example of the trackability of four-wheel steer trailers When this type of trailer is used, the trailer will follow wherever the tractor can get through, no matter how long the line may be.

Long trains of trailers, heavily loaded and operating over asphalt and concrete roadways, save enormous sums in intra-

(Continued on page 49)



This Mathews System saves its cost every three months

Thats the enormous saving over hand trucking methods that their Mathews Gravity Conveyor System is making for The Better Tires Company, Chicago. In their packing and shipping rooms, it handles an average of 1000 orders a day so quickly that this firm can guarantee six-hour service on every order. Not only that, but it also means many feet of valuable floor space saved.

A glance at the photograph above will show the great variety of packages which ride on this conveyor. Mathews rollers turn so smoothly that they will easily carry small, light packages. Yet they are so strongly built that heavy loads don't wear them out.

In spite of constant use, day in and day out, for over two years this system hasn't cost a penny for repairs. That's the kind of service that is *built into* Mathews Conveyors.

Every Mathews System is planned by our engineers to meet the user's specific needs. The saving which such a System could make in your plant might not be as large as in this case, or it may be even more. But you can figure a substantial saving over other handling methods by free gravity for power plus Mathews dependability in equipment.

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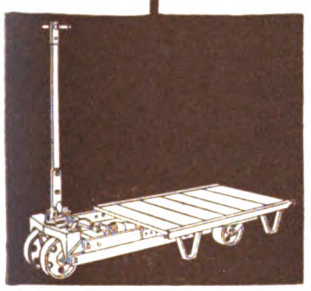
But Goodyear knows Stuebings! Since they bought their first Stuebing truck on June 11th, 1916, the labor and time saved by Stuebings in the manufacture of Goodyear tires has totaled thousands and thousands of dollars.

With Stuebing Lift Trucks your material handling can be done at a saving of up to 80%, for one man with a Stuebing does the work of five men with ordinary four-wheel trucks.

And these savings are actual, permanent savings, remarkably free from deductions for upkeep and repairs.

Of all steel construction—even to the wheels—with a frame as sturdy as the steel shell of a sky-scraper, Stuebings have in them a reserve force of strength that cannot be mastered by the wear and tear of constant use. *They are built for hard work—and they get it!*

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Stuebing Steel-Bound Platforms match the Stuebing Lift Truck in strength of build and adaptability of service. They won't wear down or wabble

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Item	Northwest Gas Crane	Standard Steam Crane	Northwest Saving Per Day
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1 Helper (if required).....	$	$	Same
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Gasoline (25 gal. at 20c)...	5.00	6.00	1.00
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Team for carrying coal and water (½ day at $8.00)...	NONE	4.00	4.00
1 Fireman	NONE	5.00	5.00
Overtime for firing up in morning and pulling fires.	NONE	2.00	2.00
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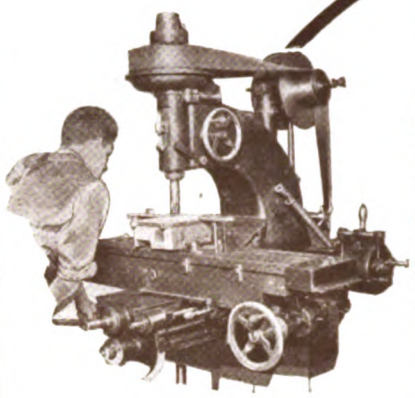
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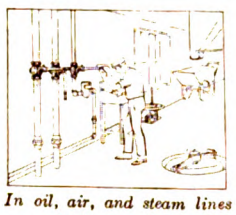
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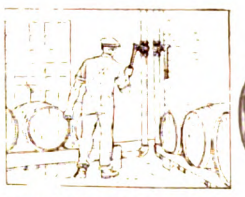


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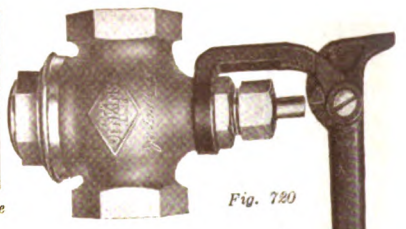


Fig. 720

Saving Time, preventing Waste in many Industries

Jenkins Rapid Action Valve opens or closes automatically with a pull of the lever. The lever stays in either position without being held, and the valve closes *without water hammer.* Made of bronze and fitted with Jenkins Renewable Disc for air, steam, water, or other vapors or liquids.

It is illustrated here in a few of the many industries which have adopted it because its rapid on-and-off action saves time and prevents waste. A valuable valve for many purposes, built in every respect up to Jenkins high standards.



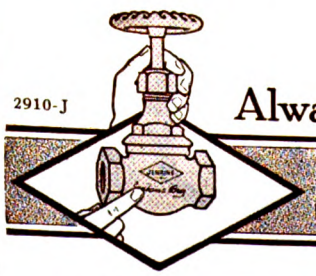
On steam lines to cloth shrinking machines.



On steam and water lines to cooking vats.

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(Continued from page 46)

plant haulage. Examples of these heavily loaded long trains, using different types of trailers, are shown in figures 8, 15 and 16.

While concrete roadways wear out somewhat quicker than asphalt under tractor trailer traffic, the reduced frictional losses offset the additional maintenance expense. Figure 16 shows a tractor making delivery of 6 trailers, loaded with approximately 15,000 pounds of material. Before delivery is completed, the tractor passes through four swinging doors, the only labor required being the tractor driver.

Special trailers for handling cumbersome materials are accessories that help to keep the tractor busy, and reduce handling expenses. Thus special trailers are usually developments by particular industries, or devices perfected by material handling equipment manufacturers for particular industries. Figure 17 shows special trailers for handling locomotive wheel tires.

Handling merchandise at freight terminals, both steamship and railroad, is one of the many places where tractor trailer trains are reducing handling expenses, and speeding up the handling of materials. Figure 19 shows a train of trailers operating on a transfer platform at a railroad terminal, while figure 10 shows a tractor trailer train entering one of the large steamship piers off West Street in New York City. There is a point to be noted in figure 10, namely that caster trailers are not recommended to be hauled any great distances over rough cobblestone pavements, as shown in this installation, because the small wheels break under the severe strain, particularly when heavy loads are carried, and it is therefore suggested that a portion of the runway entering upon pier sheds should be covered with asphalt so as to provide smooth runways for the tractor trailer trains, and still provide rough footholds for the horses that have to pull the heavy truck loads on to the pier.

Figure 14 shows a good type of trailer chassis to be used in connection with pier work. The superstructure or hopper body is particularly designed to meet the requirements of this installation, where the tractor is used for coaling the Staten Island ferries which ply between Port Richmond and New York City. The large trailer wheels are better adapted for rough runways.

Figure 21 shows an end dump trailer. These dump bodies are in the form of an attachment which is fastened to a standard four-wheel steer trailer. In case the dump bodies are not required, they can easily be detached, and the trailers can be used for handling case goods.

It is not only in the handling of trailers that tractors can be used, but they can also be fitted into installations for hauling cars where tracks are already installed. The installation shown in figure 18 is at the receiving station of the Chicago Tunnel Company. This organization is the only enterprise of its kind in the world. They operate a 70-mile tunnel system under a congested district of the city of Chicago.

SKF



Ball Bearings Defeat Friction's Destructive Effects and Reduce Power Waste

THE greatest single factor which must be combated in obtaining high operating efficiency in haulage units is friction in the bearings supporting the vital rotating parts. Friction means not only power waste but also wear of both bearings and gear teeth. Necessity for bearing adjustments and replacements is evidence of wear but no amount of adjustment can restore gears to their original high operating efficiency.

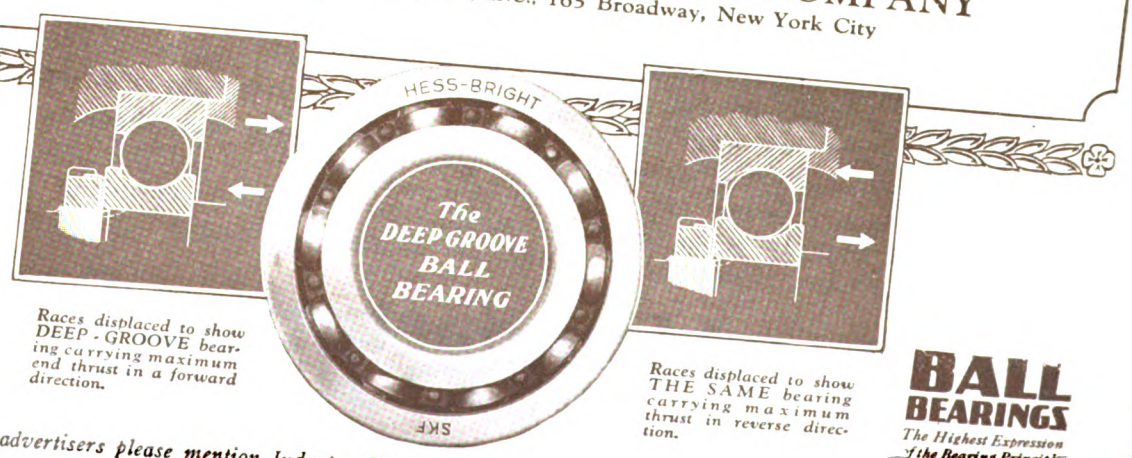
On this gasoline lumber carrier deep-groove ball bearings made by the Hess-Bright Manufacturing Company reduce power losses and maintenance to a minimum and help to keep the truck ready for service by eliminating the need for bearing adjustments and replacements. So little wear occurs that it is not noticeable after years of service.

Ball bearings on cars and trucks and on industrial and commercial machinery are an assurance to the user that precautions have been taken to insure continuity of service, high operating efficiency, maintained accuracy and economy of performance.

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Races displaced to show DEEP-GROOVE bearing carrying maximum end thrust in a forward direction.

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The Highest Expression of the Bearing Principle

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This subway system is used exclusively for handling baggage, freight, coal, ashes and building excavation material, and facilitates the movement of millions of tons of materials handled in the district bounded on the North by Chicago Avenue, on the South by 16th St., on the East by Lake Michigan, and on the West by Greene Street, and serving in a measure to relieve the street congestion of this already overcrowded district. The average tunnel level is about 40 feet below the street grade. The tunnel company operates their own freight receiving stations at the various points along the system, and it is at these various receiving stations electric industrial tractors.

While tractors are used in that they are making use of trains in the hauling of materials, they can also be used for movement of heavy machinery when setting it in position in new plants. Figure 22 shows a tractor operating in this capacity.

While care should be taken in selecting the right type of trailers, considerable attention should also be paid to the locomotive or tractor. It is evident that this is an important unit, and a tractor should be capable of developing sufficient "tractive effort" and "draw-bar pull" to haul a load and travel at the required speed. This is generally a matter of battery capacity in the case of electric tractors and the selection of the proper size motor or engine when using gasoline tractors.

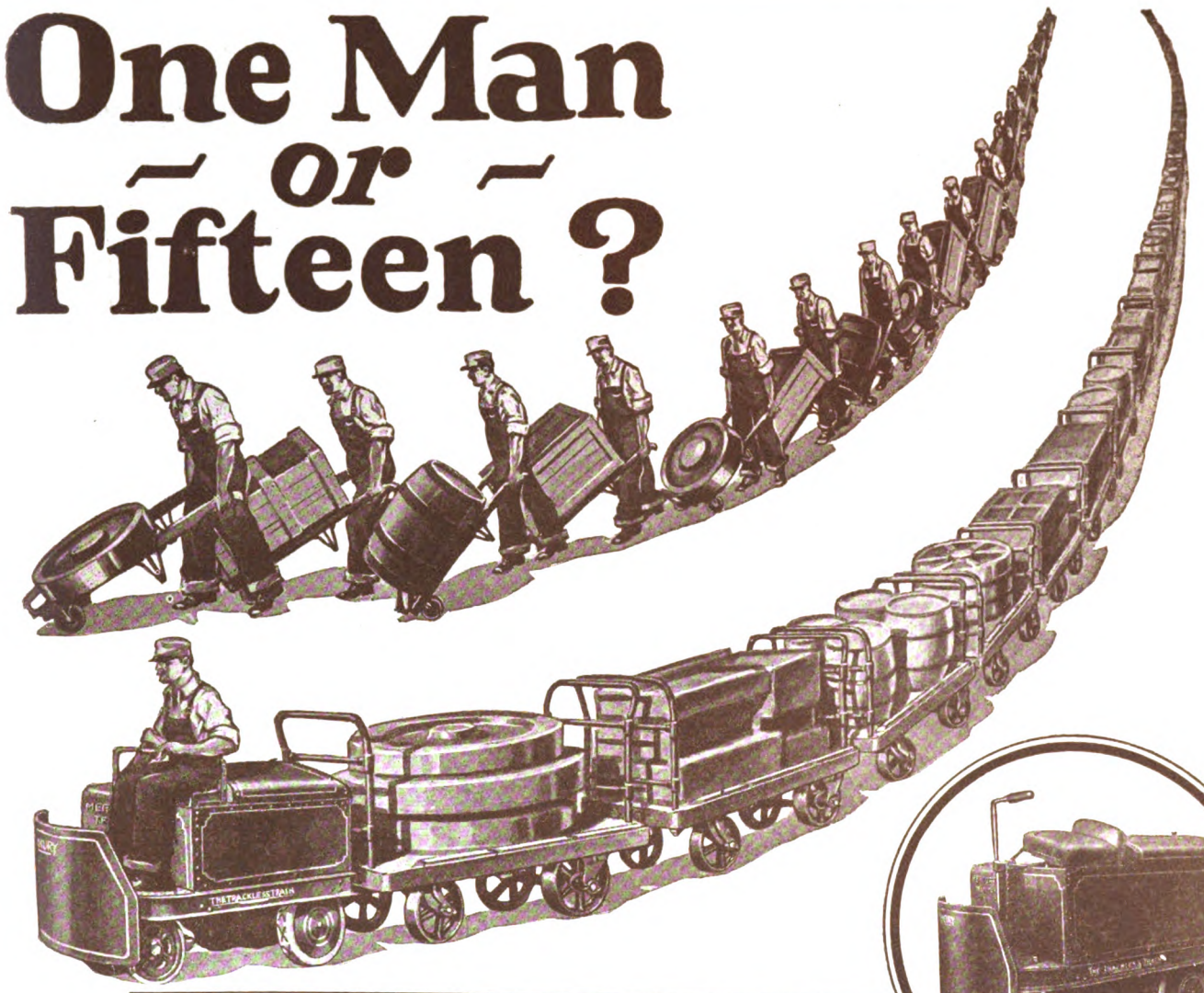
The term "tractive effort" is used to designate the force in pounds which is exerted at the tires of the tractor. The term "draw-bar pull" is employed to signify the effort in pounds at the coupling between the tractor and trailers. A tractor performs in accordance with known physical laws, mechanical and electrical. When certain elements of a material movement problem are known, the work which can be expected from a tractor can be calculated to a certainty. These elements are:

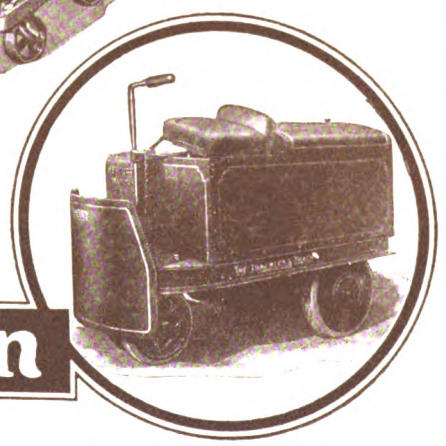
(a) Weight of the train to be hauled.
(b) Character of the surface over which the train must run.
(c) Grades which will be encountered.
(d) Speed at which the train must travel in order to move a given amount of material in a given time.

The weight of the train to be hauled and the character of the surface, determine the "tractive effort" necessary. The grades which must be overcome determine the maximum demand on the tractor. The speed necessary to move a given quantity of material in a given time determines the size and capacity of the battery, and the size of the motor or gasoline engine.

The simplest way to solve this problem is to submit it to one of the standard tractor manufacturers, as they have already figured out the capacity of their equipment under the term "draw-bar pull" and their catalogues list the capacity in pounds, both normal and maximum, and they can quickly recommend after reviewing all conditions, the best type of tractor to be used. The power or tractive effort of any tractor depends directly upon the

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The Trackless Train

THE hand truck method requires one man to propel each truck. The Mercury method enables all but one man in a gang like this to be put on productive work.

While the Mercury tractor does the work of many men, it operates at the cost of one. Interest, depreciation, electricity, oil, grease and repairs—all amount to no more than the day wage of an average laborer.

This labor and money saving system of industrial hauling is so flexible that it meets most any requirements. Narrow aisles or crowded floor space do not prevent these little tractors from winding in and out with their heavy trains. Special trailer designs handle material of unusual shape or weight. The tractors are of ample power for steep grades, and their construction is so rugged as to stand both use and abuse.

May we tell you what others are doing under conditions similar to yours? We know it will interest you. It may lead to important changes in your system of hauling material.

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weight of the drive wheels and the ability of the motor to turn them under that weight. Tractor trailer trains can draw a heavier tonnage than a load-carrying truck of equal battery capacity. The majority of standard tractors have sufficient "tractive effort" to haul train loads of 7,000 to 20,000 pounds, maintaining a speed of three to four miles an hour in the case of electric, but a slightly higher speed in the case of gasoline tractors.

Practically all of the standard tractors now being manufactured have eliminated the faulty designs which were prevalent in the first few installations, and as to whether a tractor should be of three-wheel four-wheel or center control type as shown in figures 18, 14 and 7, is purely a matter of personal preference. Frequently if more than one manufacturer is consulted, one will possibly recommend the use of a three-wheel tractor, while another will recommend the use of a four-wheel tractor. This is a small matter, and the manufacturer will generally stand back of his recommendation.

There is, however, a tendency for each manufacturer to feel that his equipment can perform all classes of work, and this is particularly true where the competition narrows down to whether a gasoline or electric tractor should be used. It is difficult to make a general statement recommending which type to employ. It can, however, definitely be stated that gasoline tractors with large wheels are more adapted to rough yard work than standard storage battery electric tractors. By rough yard work, we mean as illustrated in figure 9.

The large wheels which are on the majority of gasoline tractors, make for better operation over bumpy ground, and the use of gasoline in these instances is better, because with an electric tractor, the continual pull soon discharges the battery, and occasions the change of battery, or the boosting of batteries during the noon hour, and frequently if the work is heavy, the tractor will lag toward the end of the day.

On outside work, over rough ground, where gasoline tractors are used, the trailers should be equipped with large wheels as shown in figure 9. If small wheels are used, there is frequent breakage and rough riding for the materials.

In a number of industries where tractor trailer systems of transportation have been installed, it has been found economical to make a number of building changes, which frequently involves considerable outlay of money. For instance, a plant which manufactures automobile tires, found it advantageous to install a subway system of tunnels to take care of their tractor trains, and their industrial trucks. The use of tunnels under shops is becoming general practice. Tunnels not only eliminate traffic on the operating floor, but if properly laid out, they can be used as a point of storage, thus reducing the amount of materials standing on the manufacturing floors.

Other companies have found it advisable to build bridges between buildings, especially where materials are used on the same floor levels. By building bridges, the lowering and elevating of materials is



Controlling the Motors
On Your Material Handling Equipment

Whether crane, hoist, conveyor, elevator, industrial truck, electric locomotive, coal and ore unloaders—there is a type of C-H Control equipment that insures the maximum results.

In a tire factory, the manual handling of tire moulds was practically eliminated and production speeded up by means of two conveyor systems driven by eight electric motors controlled by Cutler-Hammer Automatic Push Button Control equipment. One operator on a platform has entire control of each conveyor system by means of eight C-H Push Button Stations.

In case of emergency—safety stop stations, located along the conveyors, allow instant stopping.

In a lumber yard a conveyor with Cutler-Hammer Control carries lumber along the yard and by means of a C-H Magnet-operated deflector, lumber is tossed off at different points—all under the control of one man located on a raised platform.

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This accumulated experience and data are available to solve your problem—C-H engineers in the various district offices are ready to consult with you.

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C-H CUTLER-HAMMER **MOTOR CONTROLLERS**

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reduced to a minimum, and invariably the bridges pay for themselves by the reduced operating expenses.

While considerable has been said regarding the best type of tractor and trailer to be used, there is still a more important item, namely; the men who operate the system. It must be remembered that production depends on getting the materials from one point to another on schedule time, and for this reason a fairly intelligent workman should be selected as a tractor driver. The dispatchers and superintendent of transportation should be men of ability. Where a driver is intelligent, and can be interested in his job, he will facilitate the movement of materials to a great extent, and will readily meet the small difficulties which must constantly arise in any such job, and can overcome them without having to delay proceedings for minor instructions.

At one time it was the practice to have a tractor driver and a helper for each train, but experience has shown that far better results are obtained by eliminating the helper. The trains can be made ready, so that the driver does not need a helper. By using only one man (the driver) it is found that there is less loitering, horse play, etc., and less time is actually spent in preparing the train and getting it under way.

Care should be taken that all safety measures are provided, and while it is essential that the tractor train, to make the best possible speed should have the right-of-way over hand trucks, etc., the drivers should be cautioned and necessary signs and instructions should be posted at intervals, so that they will sound a warning for pedestrians. All workmen should be instructed that they are never to ride on the trailer train, as this is the source of the majority of accidents occurring where tractor-trailers are in operation.

Each industry employing the tractor-trailer system of transportation, has its own peculiar adaptation of the system, but most all successful operations follow the principles of railway operation.

To-day, progressive executives and boards of directors, in designing new industrial buildings, warehouses and terminal structures, are beginning to realize the great importance of the proper allowance for internal transportation.

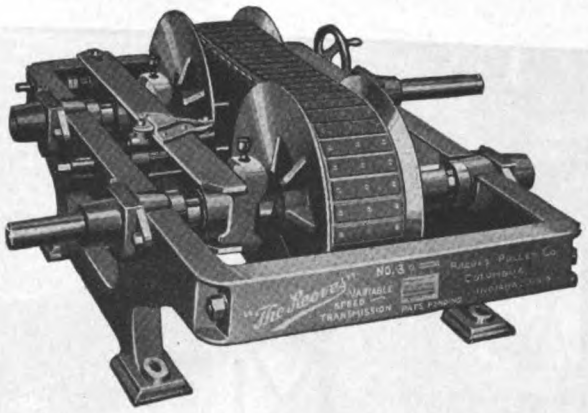
The Studebacker Automobile factory at South Bend, Ind., stands out prominently in this respect. The engineers here designed the structure about the proposed transportation system. The reason for this procedure was the collection of itemized costs data showing the large proportion of costs which is incurred in moving material from the receiving platform through the operations to the shipping platform. One piece of material may easily move a distance of 5,000 feet about the factory, from the time it is received as raw material until it is shipped, and hundreds of tons of material per month are handled through a single moderately sized factory.

Another such case is the plant of the Youngstown Pressed Steel Company, where, owing to the large volume of

(Continued on page 54)



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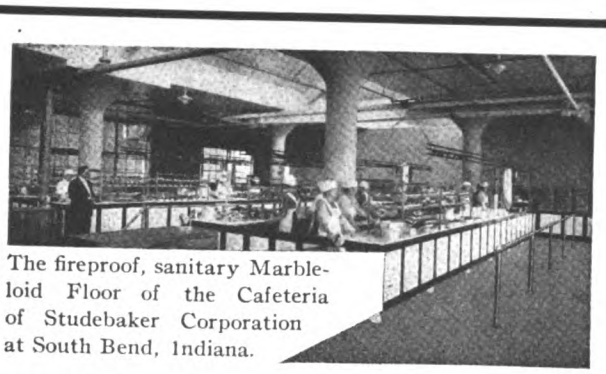


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WHAT IS IT? A variable speed mechanism.
WHAT WILL IT DO? Decrease and increase speed,
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WHERE? Conveyors or any production machine.
WHEN? Whenever you want it,
HOW? By turning an adjusting wheel.
WHAT DOES IT COST? Nothing. Saves cost after installed.
HOW CAN I PROFIT? Put your variable speed problems up to us.

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THIS FLOORING USED EXTENSIVELY IN INDUSTRIAL BUILDINGS

Marbleloid is a fireproof, resilient, non-abrasive, non-slipping composition flooring material which does not require expensive upkeep and can be laid upon old or new wood or concrete floors. It is laid plastic and sets in a few hours into a seamless, smooth surfaced floor, good for a lifetime of service.

We have made a large number of installations of **Marbleloid Floors** in the offices, laboratories, hospitals, and restaurants, cafeterias, welfare rooms, work rooms, toilet and locker rooms, display rooms, etc., of industrial plants.

Marbleloid Flooring is manufactured and installed by our organization and guaranteed by us.

MARBLELOID
The Universal FLOORING for Modern Buildings

The coupon below will bring you additional facts

THE MARBLELOID CO., 467 Eighth Ave., New York

THE MARBLELOID COMPANY, NEW York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building.....; below are the approximate areas involved. Floor.....Sq. Ft. Sanitary Base.....Lineal Ft. Wainscot.....Sq. Ft. I have checked the floor troubles we now have.

Our floors are

☐ New Concrete ☐ Cement Finish ☐ Wood
☐ Cracking ☐ Cold ☐ Slippery
☐ Dusting ☐ Splintering ☐ Unsanitary
☐ Noisy ☐ Rough ☐ Rotting

Name .....
Firm .....
Address .....
☐ Please send 32-page Illustrated Booklet



Don't Build Wood Shelving



Van Dorn *Convertible* Steel Shelving Costs No More!

Van Dorn Steel Shelving, on the average, costs no more than wood construction; the first cost is the last cost; and unlike wood it offers quick erection, quick dismantling, quick reassembling, in the same or different form, at the same place or somewhere else.

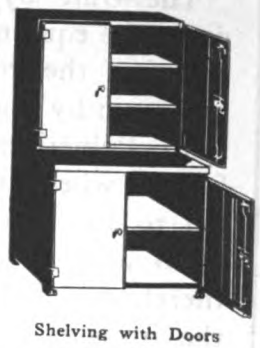
Your storage requirements do not "stay put," If you haven't changed your shelving for a long time, it isn't because you don't ***need*** the alterations, but because you've been willing to put up with growing inefficiency and annoyance!

Once you know the economy and convertibility of Van Dorn Steel Shelving you will use no other. Send for catalog.

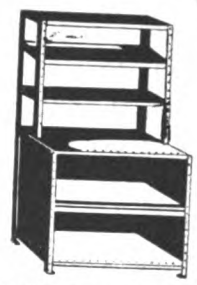
The Van Dorn Iron Works Company
Master-craftsmanship-in-Steel
CLEVELAND

Branches Offices:
New York, Washington, Chicago, Pittsburgh, Los Angeles, Philadelphia, Cleveland

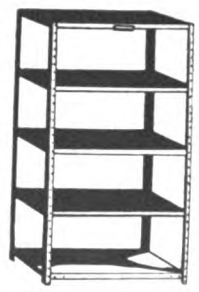
From standard parts that are carried in stock in various sizes, any form of shelving may be constructed — skeleton type, or with sides, backs and doors; optional reinforcing for heavy loads; in styles for factory use or, with attractive cover strips, for the finest office; in solid banks, or run beneath or over windows, stairways and the like.



Shelving with Doors



Ledge Type Shelving

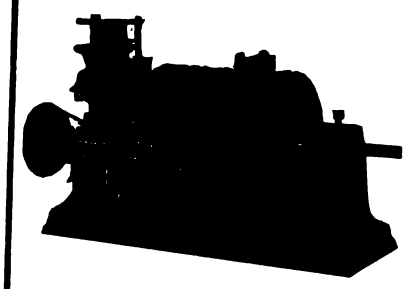


Skeleton Shelving

Van Dorn
MASTER-CRAFTSMANSHIP IN STEEL

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Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway New York

(Continued from page 52)

material that was to be handled in the manufacture of steel stampings, prime importance was attached to the layout of the routing of materials.

It may readily be seen why it is so important to design an efficient material handling system about which to construct a factory, when it is realized that the savings made by such a system are often equivalent to the net profits of the business. Many concerns have been able to reduce costs, enabling them to effectively complete, and consequently show a better profit, by installing a better method of materials handling in a factory already in operation. It behooves owners and managers to stop and consider the savings that are being made in newly constructed factories through proper internal transportation systems, and it will also pay them to look into their own factories, and see if it will be possible to employ tractor-trailers to assist them in cutting costs.

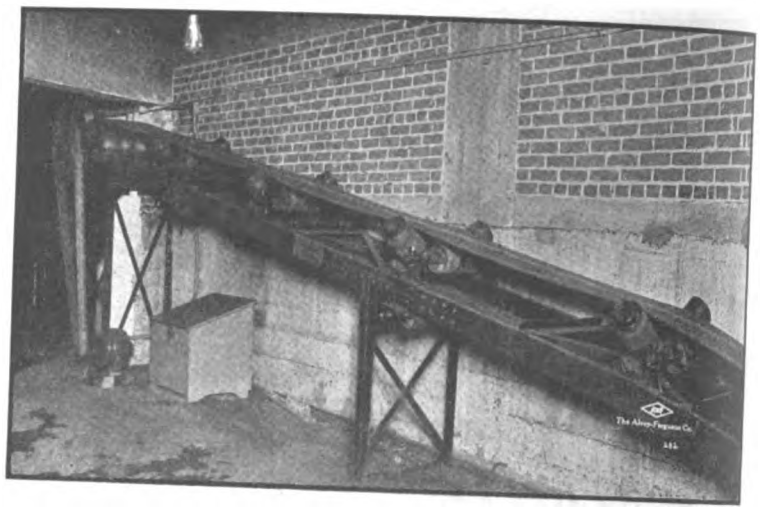
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PLUGGING THE POWER LEAKS

American Engineering Co.
Brown Instrument Co.
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General Electric Co.
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DEVELOPING THE FULL CAPACITY OF THE FACTORY TRUCK TRACTOR

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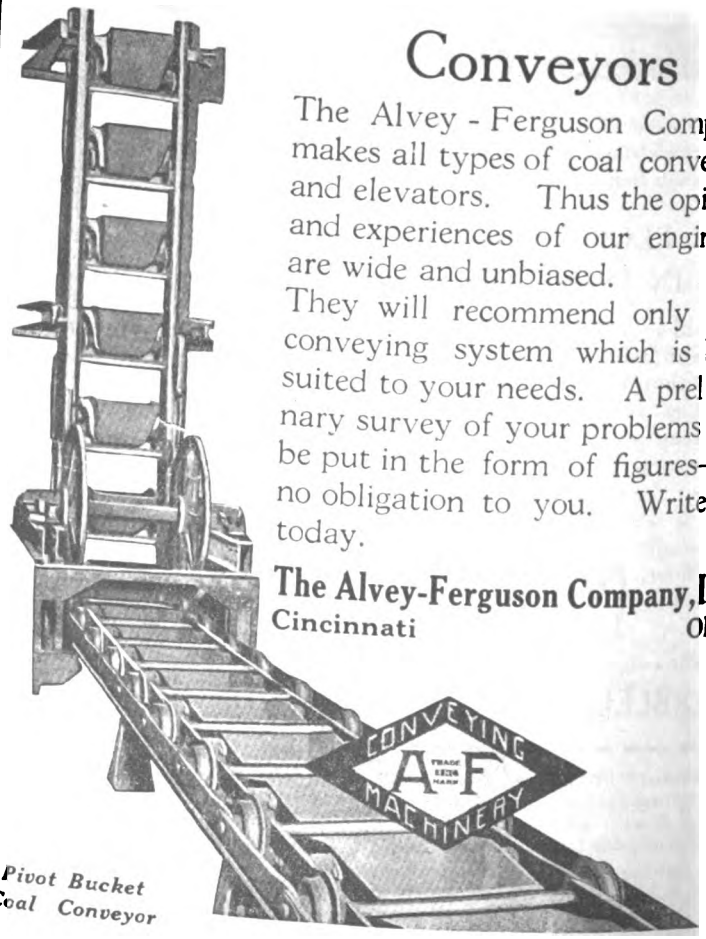


What Is Coal Costing You?

Carload prices are only a part of coal cost. Handling expenses must be added to reach the correct figures.

The high cost of coal and labor has made manual unloading and handling practically prohibitive. Mechanical methods effect a surprising annual saving, as evidenced by plants using

CONVEYING A=F MACHINERY



Pivot Bucket Coal Conveyor

Conveyors

The Alvey-Ferguson Company makes all types of coal conveyors and elevators. Thus the opinion and experiences of our engineers are wide and unbiased.

They will recommend only that conveying system which is best suited to your needs. A preliminary survey of your problems will be put in the form of figures—at no obligation to you. Write us today.

The Alvey-Ferguson Company, Inc.
Cincinnati Ohio

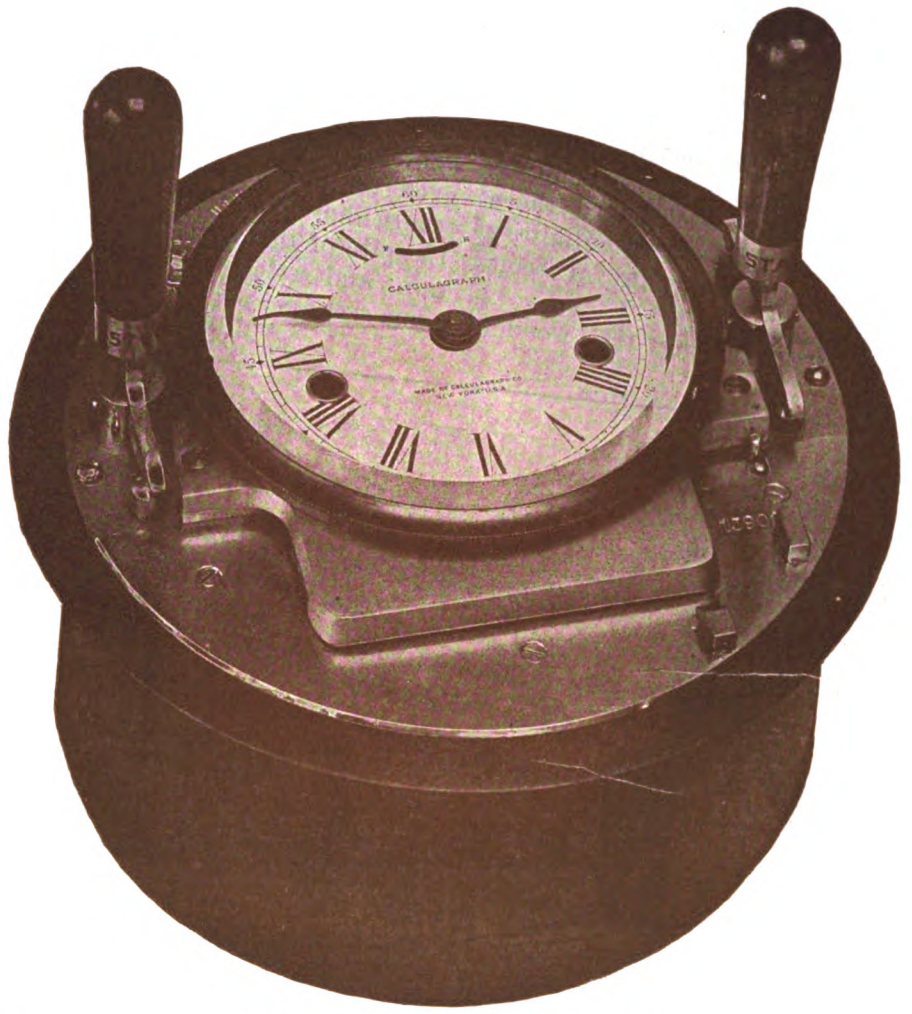
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The Calculagraph Would Have Computed Tom's Time Mechanically

"How long did that job take, Tom?"

"Well, I started it about half-past ten, took half an hour for lunch, and finished at a quarter after three. That makes—let's see—four hours and fifteen minutes. And out of that I helped Bill for about ten minutes. Say four hours."

Do you let your employees figure "elapsed time" the way Tom did?

Not quite so crudely, perhaps.

But do you put it up to your workmen to keep track of the time they have spent on a given job?

Think of the time they lose—and the more conscientious they are the more it amounts to—in figuring it out.

Not to mention the time it takes *other* employees to decipher the often badly written work tickets.

How can you expect to get accurate cost sheets, in which labor plays such an important part, by any such crude methods?

There is only one modern way to do it—by the Calculagraph.

For the Calculagraph figures elapsed time in one operation—instantaneously, accurately, legibly. You merely put in your work ticket, pull two levers, and the job is figured for you.

The Calculagraph takes the guess out of cost sheets. It saves its first cost over and over again in a year. It is an essential part of the equipment of a modern factory.

If you would like to see how the Calculagraph works, and how it can be applied to your business, send for booklet "Elapsed Time Records."

THE CALCULAGRAPH
THE ELAPSED TIME RECORDER
34 Church Street, New York City

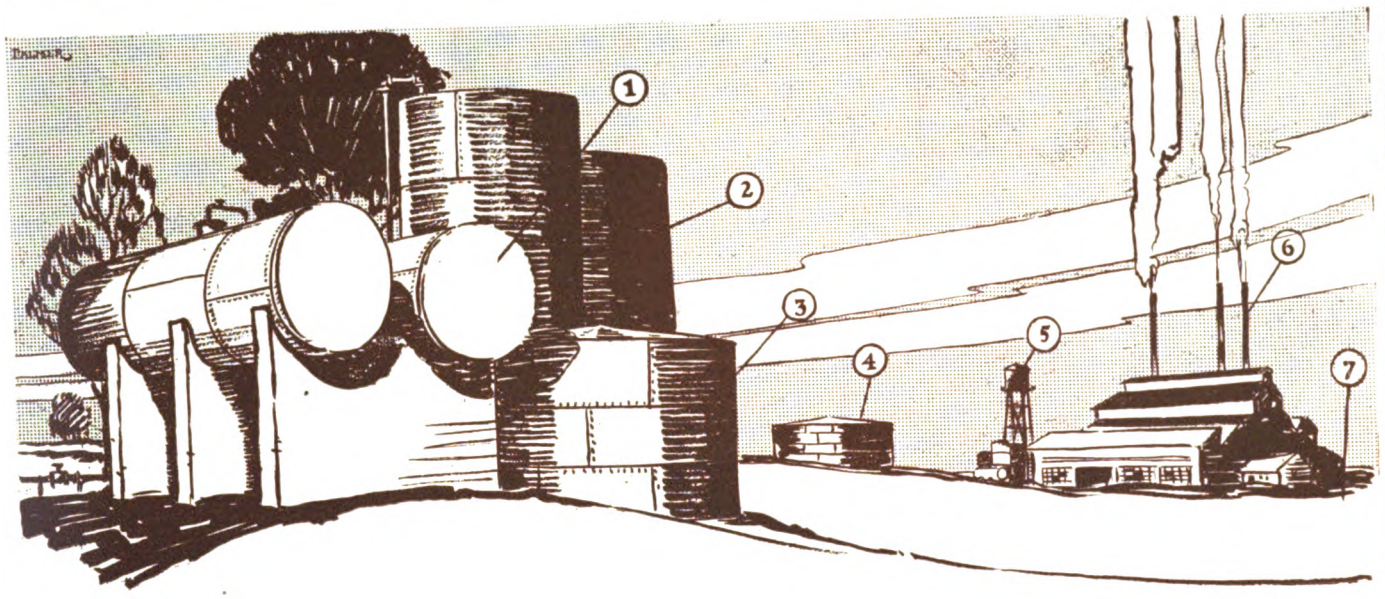
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Making Bodies for Ford Cars

(*Continued from page 13*)

beams and structural shapes, nor does wood equal these other materials in uniformity of texture. Knots and checks, for example, have a disturbing way of appearing in inconvenient places. And so in the conduct of the saws, where the scheduling of production virtually begins, or where, in other words, the decision is made as to just what part shall be made out of each board, there lies surprising potentialities either for waste or for economy.

In examining the wooden frame work of Ford cars of every body type the visitor finds a complete freedom from knots and checks. This is true even on parts and in places where they would do no harm. In spite of this careful inspection and selection, however, some sixty per cent. of the total footage sawn daily is actually turned into body parts. In other words, the board foot contents of the finished parts made from a day's cutting will amount to sixty per cent. of the original footage sawn. The remaining forty per cent., however, is not loss as we shall see later. When it is considered, however, that in many body plants where knots are not taboo, the average utilization falls to forty per cent. or below, these figures take on their true significance.



The secret of this remarkable utilization, as said before, lies in the sawing. In many, perhaps it may be said in the average woodworking plant, if a thousand pieces of a certain dimension are to be made the sawyer will get an order for a thousand pieces of certain thickness, width, length and kind of wood, and will proceed to saw up the stock straightaway as it comes, cutting out knots where too near the edge of a cut and discarding leftovers from the end of the board. In the Ford body plant no straightaway sawing is permitted. Each swing saw takes care of a certain thickness of board and is provided with from five to seven stops permitting five to seven distinct pieces to be sawn according to the sawyer's judgment. With this leeway and with men carefully trained to use it, there is surprisingly little waste at the saws.

All through the subsequent operations each workman is alert to save pieces of stock which may be successfully made into something smaller but which would normally be regarded as waste and thrown away. This practice extends to even tree cornered and other odd shaped cuttings from band saws. So far does Mr. Ford's insistence on this practice go that he has these odd shapes collected in burlap bags and saved for utilization. Some of this utilization cannot be had by making product parts for the reason that there are not enough of these small product parts to use up all of this waste. In this case some other product must be found for which this is suitable raw material, whether it be small handles,

(*Continued on page 58*)

Are You Using Tanks--The right Tanks?

1. Horizontal
2. Vertical
3. Small storage
4. Fuel or field storage
5. Water storage
6. Stacks
7. Underground Pressure Storage

There are so many kinds and varieties of Tanks for containing or storing so many different kinds of materials that the question of the Right Tank is often confusing even to an expert buyer.

To know what type, size and design of tank is best adapted to meet the requirements for the different kinds of materials to be stored calls for highly technical tank knowledge and experience—if costly mistakes are to be avoided.

For over twenty years, Lancaster Tank Specialists have been assisting various industries to determine and select the right Tanks for their especial needs. You will find that the advice of the Tank Engineers of Lancaster will be of utmost value to you. Consultation is free.

Our Service Department has compiled three books of practical value to users of Tanks. BOOK J-1, Prices and Specifications 303 sizes Horizontal Storage Tanks, 100 to 25,000 Gallons. BOOK J-2, Storage Tanks from 1,000 to 74,000 Barrels, BOOK J-3, Prices and Specifications of 134 Standard Sizes Pressure Tanks. Any or all of these books sent free upon request.

Lancaster Iron Works, Inc.

LANCASTER, PENNA.

New York
501 Fifth Avenue

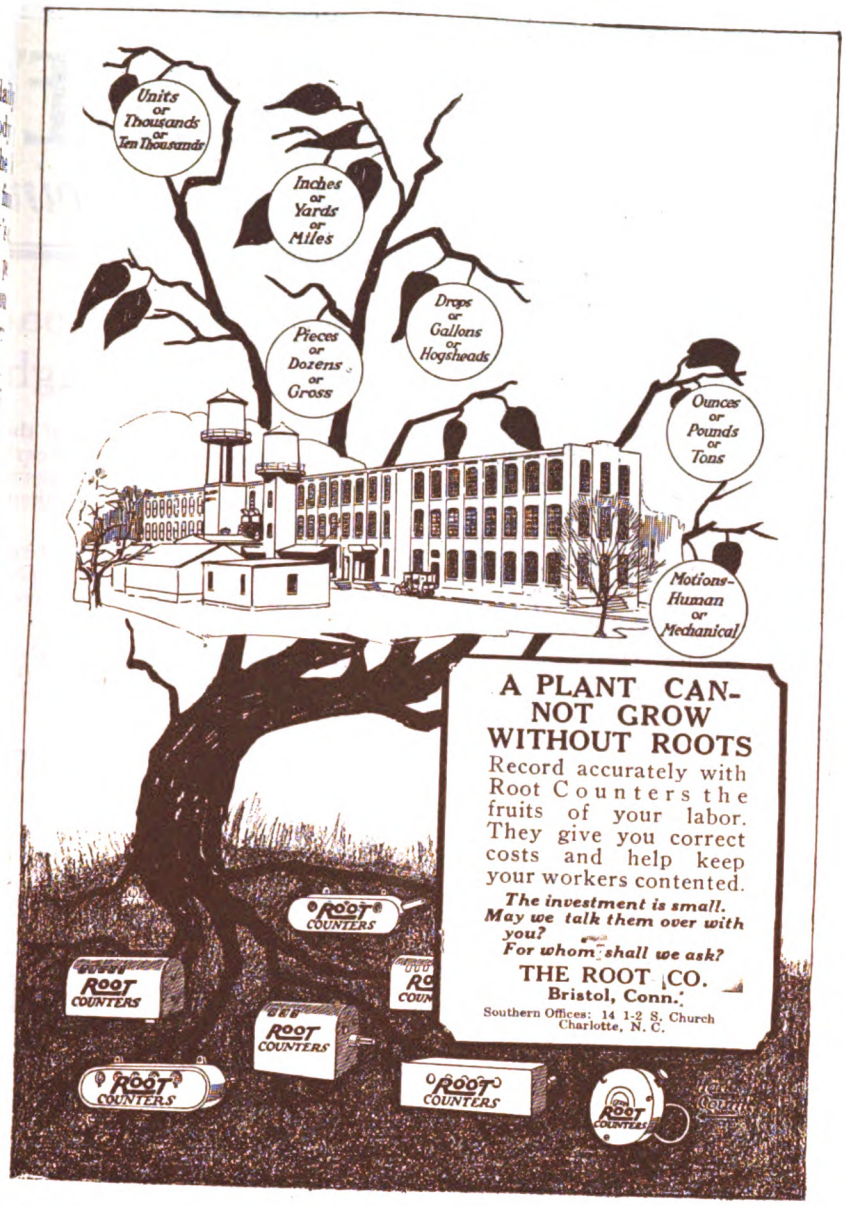
Philadelphia
Wesley Building

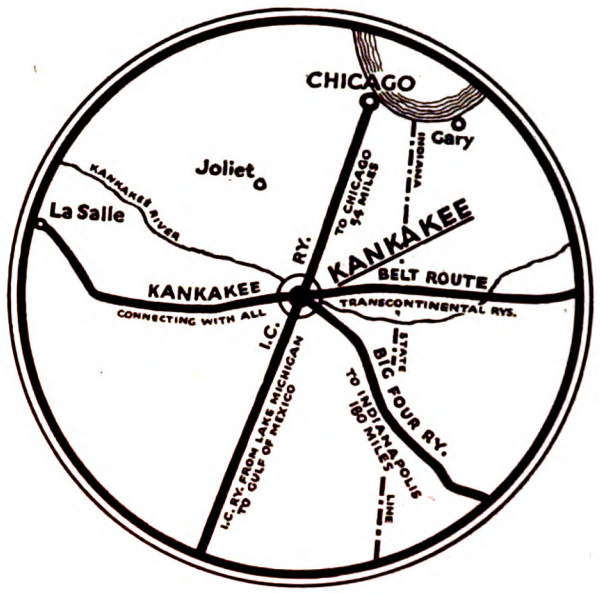
BE SURE YOU GET THE RIGHT TANK

LANCASTER TANKS
STEEL PLATE CONSTRUCTION

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Factories Make Money in Kankakee

KANKAKEE ILLINOIS offers an unusual combination of favorable circumstances for the industry seeking a location. It has all the advantages of a moderate sized town, yet is within 90 minutes of Chicago.

KANKAKEE enjoys the same freight rates and divisions as Chicago. But it does not have the congestion of the bigger city.

Located in the heart of the middle west, where industry is moving. Close to the great Gary steel district. An open shop town with a plentiful supply of skilled and casual labor. Eight-eight per cent of Kankakee's population is native white.

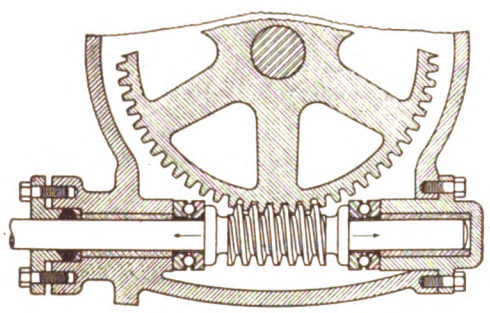
Coal within twenty-five miles. Water power from the Kankakee river. Public utilities from the great Public Utility Companies of Chicago. Forty-four steam passenger trains 98 freight trains, 12 interurban passenger trains, and 2 interurban freight trains pass through Kankakee daily.

If you are seeking a new location for your plant, or considering the establishment of a middle-west branch, write for the complete story of Kankakee.

J. N. SLETTEN, Secretary
Chamber of Commerce

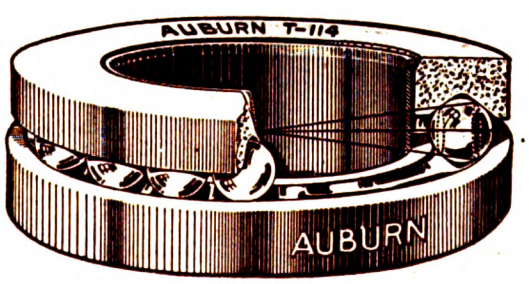
KANKAKEE
ILLINOIS

WORM DRIVES need less care with AUBURN THRUSTS



Auburn Ball Bearings on Worm Drives mean maintained alignment, reduced friction and wear, less attention for bearing takeups and renewals.

They make your machine more dependable. Send Blue Prints with data of your conditions and let us assist you to increase the reliability of your equipment.



STEEL, BRASS AND BRONZE BALLS.

AUBURN BALL BEARING COMPANY

24 Elizabeth St., Trade Mark Rochester, N. Y.

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(Continued from page 56)

spools, or wooden novelties.

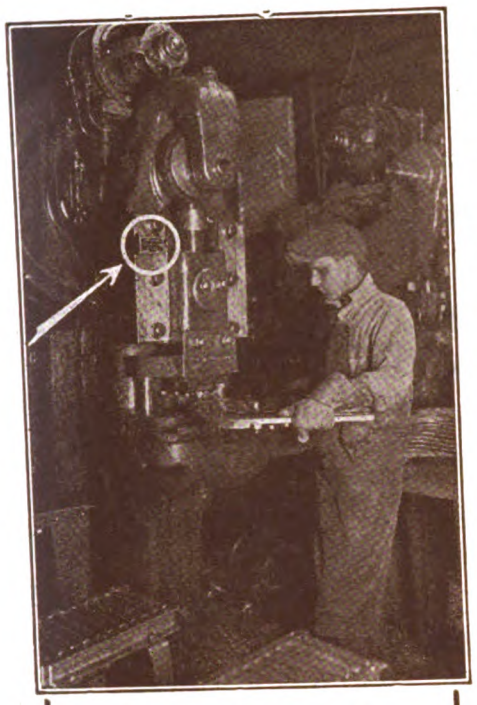
The first stage of side frame assembly consists in attaching the body brackets and cowl pillars at the ends of the sill. Body brackets are prepared ready for bolting to the sill on two double benches at the origin of the assembling conveyor, and are attached to the sill on the conveyor, on the move. For the assembly of the cowl pillar the sill is removed from the conveyor and taken to one of the double work benches D. This completed, it is placed again on the conveyor and proceeds to the wood frame assembly benches.

These benches are in reality extremely ingenous assembly fixtures in which every detail is the result of long experience. They provide not only the means of clamping the sill and cowl pillar securely while adding the remaining wooden parts to the frame, but they also serve as receptacles for all of the screws, nails and tools; the glue pot, and underneath, for the wooden pillars, top members and cross braces.

One framer works at each framing bench. First he takes the sill with body brackets and cowl piller attached from the conveyor and places it on the framing table, fastening it securely with quick-acting clamps. Next he takes the brush from his electrically heated glue pot and applies glue to the gains or notches in which the upright pillars are to be fastened. While he is doing this he has already selected an upright and has prepared it for placing in the sill. Next he fits the cross members and glues them, after which he reaches for a suspended electric portable drill hanging over the table, and drills the screw holes through the wood members. Finally he inserts and tightens the screws, nails the tenons, and the frame is complete, ready for paneling. The entire operation requires about three minutes.

The completed frame, again placed upon the assembling conveyor, proceeds to the paneling benches. There are two sets of these benches on which the metal body panels are attached to the wood frames. One set of these benches is for right-hand side assemblies and the other for left-hand, this

(Continued on page 60)



In the Ford Body Shop Production Checked with model "B" Gear Counters

These give a reliable check on production. And the choice was R. A. HART Gear Counters after thorough investigation of the various methods used in industry for checking output per man.

In the body shop at River Rouge every machine is equipped with a model "B" Gear Counter and throughout the Ford plant 2100 HART Counters are in use. Cost of maintenance almost nothing.



R. A. HART Gear Counters

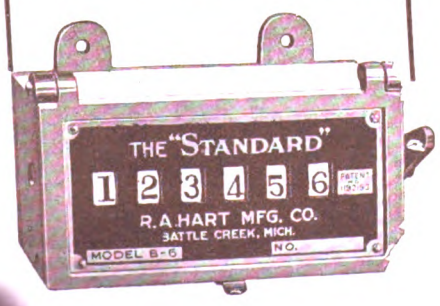
offer a reliable and accurate check on production and output. They show the figures at a glance, at any time.

They register up to 100,000. Constructed on gears—can be reset in a moment.

R. A. HART Counters have large plain figures—Steel Shaft—Steel dogs and Steel rachet wheel hardened.

Write for prices and further information.

R. A. HART Mfg. Co.
10 Wilson Court
Battle Creek, Mich.



MATCHLESS TROLLEY

"Easiest to Start-Easiest to Keep Going"



Pulling a 1-ton Load with a 14-lb. Weight

The test shown is graphic proof of the little effort required to start a heavy load and convey it to any desired point, when carried on a Matchless Timken-Roller-Bearing Trolley.

At 14 lbs. the trolley with its 1-ton load, started smoothly and rolled rapidly along the length of the overhead rail.

The Matchless required only about half the pull demanded by any other trolley—ball or roller bearing—when given the same identical test.

Matchless Trolleys in your plant mean less energy used, speedier action and more output per man.

Chisholm-Moore Matchless "Trolleys," "Cyclone" Chain Hoists, and "Carryall" Overhead Track Systems carried in stock by capable distributors in all localities.

Complete catalog, price, and name of nearest representative on request

The Chisholm-Moore Mfg. Co.
Cleveland, O.

Hoists Cranes Trolleys Overhead Track Systems

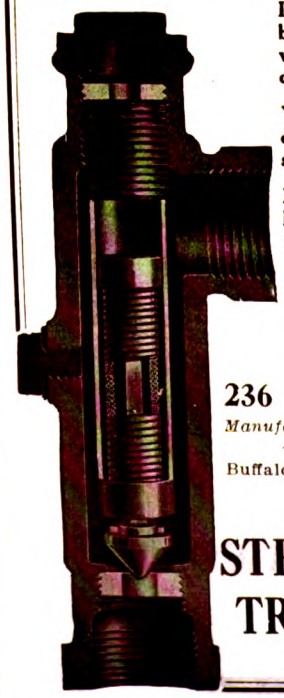
Branches: New York, Chicago, Pittsburgh

1c a Day Saves $5.74 Daily

AN UNTRAPPED ¾-in. steam pipe in your plant would waste 820 lbs. of coal every 24 hours. At the present cost of coal that means a loss of $5.74 a day—$1,722 a year.

Perhaps there are several untrapped or poorly trapped lines in YOUR plant at this moment! If so, you can prevent enormous waste by installing the Steam Trap Sarco. The ¾-inch size costs only $9.45 list.

At that price the Sarco will cost about 1c a day even if you charge off 33⅓% of its cost per year. And after three years it will go right on saving money for years, at no cost to you—for thousands of Sarcos have been in continuous service for more than ten years.



Isn't the Sarco a worth-while investment on that basis, especially when you may try it 30 days without charge and demonstrate that it will do as claimed?

You can purchase three Sarcos for the price of one bucket type trap, and the Sarco will do the same work.

In addition, the Sarco screws right into your pipe line and eliminates the cost of building a platform or digging a pit.

Write today for Booklet R-33 and follow the road to steam conservation

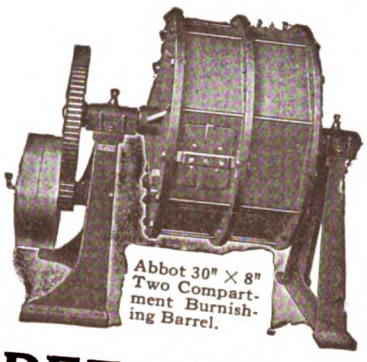
SARCO CO., Inc.
236 Broadway New York City

Manufacturers of Steam Traps, Radiator Traps, Temperature Regulators, Indicating Thermometers, Strainers, etc.

Buffalo Chicago Cleveland Detroit Philadelphia
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STEAM TRAP SARCO

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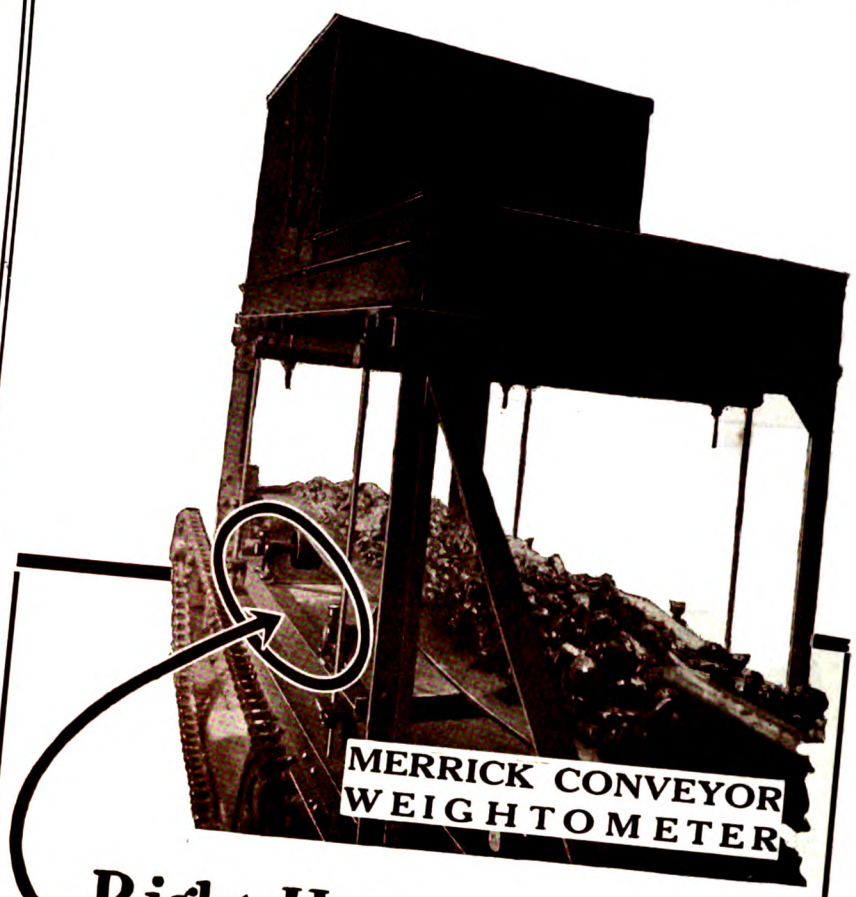
To those manufacturers of small metal parts who do not know the advantages of the Abbott Method of Polishing—but would like to have the satisfaction of knowing, positively, that they can reduce the expenses of their finishing department—we will polish samples of work without cost.

The Abbott Method is equally efficient on steel, brass, copper, nickel, silver and gold.

Send samples and ask for catalog.

Originators of Commercial Ball Burnishing

THE ABBOTT BALL COMPANY
Box 312 A **Elmwood, Conn.**



Right Here

is the Greatest Money-Saving Section of this Conveyor

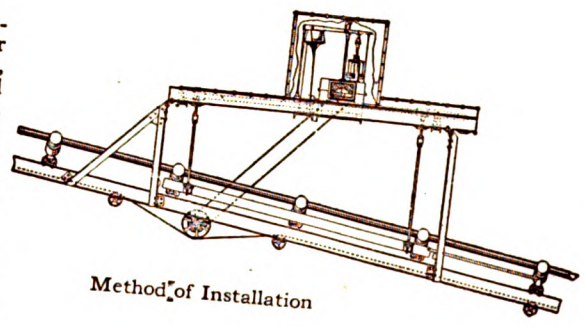
The Merrick Weightometer weighs all conveyor-handled materials ***while in transit*** and is ***guaranteed to be 99% accurate.***

No labor is required, as it weighs automatically and records the weight of the materials as they pass thru.

Send for the "Merrick Circulars," which contain graphic descriptions of the many types of installations. No obligation—glad to send them on request.

The MERRICK CONVEYER Weightometer

is in use in hundred of plants for weighing Coal, run o'mine and crushed; Coke, Stone, coarse and fine; Gravel, Sand, Cement Rock, Phosphate Rock, Phosphate Pebbles, Wood Chips, Sulphite Pulp Slabs, Fish and Fish Products, Ores, Etc.



Method of Installation

MERRICK SCALE MFG. CO.
180 Autumn St., Passaic, N. J.

THE TOWMOTOR VS THE LABOR SHORTAGE

THE TORBENSEN AXLE CO.
MANUFACTURERS OF
TORBENSEN
INTERNAL GEAR TRUCK DRIVE
CLEVELAND

The Towmotor Co.
Cleveland, Ohio.

Attention—Mr. F. W. Sears

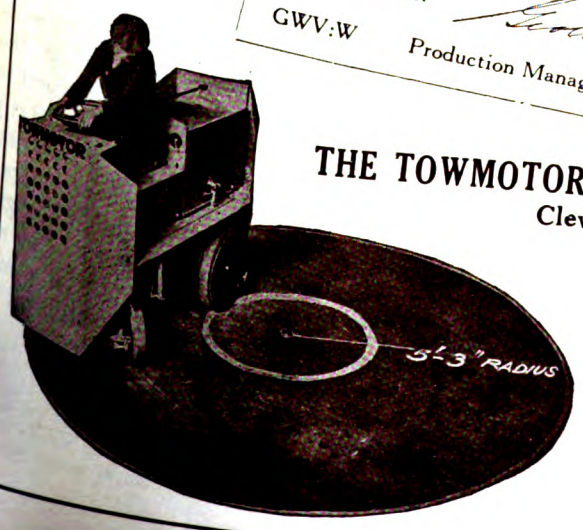
Gentlemen:

With reference to the Towmotor which we recently bought from you, as you know, we bought this machine only after making a very thorough investigation and after several days experimenting on our shipping dock with this and other types of machines. This fact alone indicates that we are well satisfied that the Towmotor will do our work in an efficient manner.

Very truly yours,
The Torbensen Axle Company

Signed:

GWV:W Production Manager



THE TOWMOTOR COMPANY
Cleveland, Ohio

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(*Continued from page 58*)

necessitated by the fact that the two sides differ, not only in hand but in the fact of having a blind door on the left-hand or driver's side.

The paneling benches are worked out with the same care and ingenuity as the framing benches. They differ, however, in that three men are assigned to each bench. First the rear one-quarter and side panels are placed in the jig after which the wooden frame is superimposed, the panel flanges then are hammered down and nailed and the paneling is completed. This operation takes approximately a minute and a half after which the assembly is again laid on the assembly conveyors, to proceed to the door hanging lines shown in the diagram at F, where the doors are hung and fitted. En route to this point various dinging and smoothing tables are passed where pieces that contain bumps or dents in the sheet metal undergo treatment.

The door hanging lines are progressive lines consisting of work tables on which the paneled side frames are placed in upright position, and held by quick acting clamps while the various operations are performed. For the touring car there are four stations, each side being slid from one to the next upon completion of each operation. A side frame complete with its metal paneling but without doors, is first placed on this line. It is then drilled to templet for hinge screws, after which it is slid back to the second position where the door latch catch is fitted. Progressing to the third position, the door is hung and two screws driven home, while in the fourth or last position the remaining screws are driven and the door fitted to swing and catch properly.

The doors being hung, the side frame assembly is placed on the belt conveyor which carries it to the finishing tables. Here the assembly is gone over carefully by experts and the finishing touches which may be needed are added. This completed, the assembly is hung like a side of beef on the trolley conveyor, which carries it to the paint spraying hoods.

The exterior finishing of all Ford bodies is taken care of at the branch assembling plants. Therefore, the spray hoods mentioned above are used merely for coating the inside of the frames and doors to protect the metal from rust and the wood from decay. A black asphaltum mixture is sprayed over these parts, the frame being rehung on the conveyor which carries it to the edge of the mezzanine and down to the central shipping bay. Descending on an incline along the line, this conveyor carries the frames to the extremity of the car loading area and then makes a 180 deg. turn, bringing the bodies in endless procession past the doors of the waiting freight cars. Thus the bulkiest parts of the entire shipment are brought directly to the cars by mechanical transportation, each shipper picking off the number of right and left hand sides that he requires to make up his car, whether this be a shipment of touring cars or roadsters.

Specializing in "licking trouble"

Standardizing on difficult castings

We are *not* interested in the kind of castings that any ordinary foundry can produce satisfactorily.

We *are* interested in those that the ordinary foundry can*not* produce satisfactorily.

Our foundry, our organization, and our methods have been developed to do extraordinary work.

When we use them for ordinary work we are guilty of waste.

Practically all the work we do consists of jobs on which other foundries have failed in one of two ways.

Uniformly satisfactory

Either they have failed *entirely* to produce any satisfactory castings, or, more frequently, they have failed to produce castings that were *uniformly* satisfactory.

Our customers consist of organizations who have found that even though rejected castings are paid for by the foundry, no one can pay them for the troubles, costs and delays always attending rejections.

Send blue prints

Send us your blue prints for jobs with which you are having trouble.

Our specialty is "licking trouble" and keeping it "licked."

We are not interested in ordinary work that an ordinary foundry can do well enough.

Nugent Steel Castings Company

Formerly ELECTRIC STEEL COMPANY

Wood and 31st Streets, Chicago, Illinois

NUGENT STEELNS

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Eliminating The "Take Homes" of Lamp Bulbs and Increasing Operating Efficiency Through Lamp Guards

When "A" slips a light bulb into his pocket on the way out of the factory, he thinks nothing more of it than if you carried home a pencil or a rubber band. It is not "theft".

But purchasing departments and superintendents keeping records almost always find a steady outward flow of unprotected bulbs—and because the loss runs into considerable figures in the course of a year, they have adopted in many cases, the simple expedient of guarding their lamps.

Generally they will first buy guards for a limited number of "exposed" lamps. But if "A" wants a lamp he will stand on a box to get it and after a short trial the order for guards is generally enlarged to cover practically all lights in the plant.

To the average workman the sight of the guard over the lamp is sufficient deterrent to discourage any attempt to take the bulb.

On the other hand, there is always present some of the type which show their skill in defeating the intent of the guard. They think it a good joke to take the lamp out of the socket, leaving the guard intact, but empty.

The second class, the man who figures out how to take the lamp and leave the guard intact, is the one who gives us real concern. He can extract a lamp from an ordinary guard in less time than it takes to tell. Mind you, he seldom removes the guard for he has learned that without the key the present day lock used on guards is hard to open and close.



A third class is the man who destroys the guard in order to take the lamp or who takes the guard and lamp. Such an individual is very rare and except in cases of flagrant theft for resale purposes is seldom encountered.

Reflector Type Guards.

Before discussing the most efficient type of guard, it is adviseable to mention the modern reflector guard.

Most of these guards are employed in and around shops where machine work must be closely watched and where an open lamp would tend to blind the workman's vision and make his work less effective.

However, don't think that because you may have never had a call for guards of this type, that your shop does not need them. Take a walk around and see. "A" is resourceful. He has already placed a piece of cardboard, sheet metal or some such device over his lamp. Considerations of accident or fire resulting from this action are none of his affair.

He wanted his eyes shaded and he took the shortest route.



The Effective Type of Guard

Without going into any competitive comparison, we believe it fair to state that the FLEXCO and FLEXCO-LOK expanded steel guards most effectively prevent the unauthorized removal, while protecting lamps from breakage.

For a number of years we studied this problem. Finally the present FLEXCO-LOK and FLEXCO re-enforced expanded steel guard was perfected. Because of its scientific design it affords maximum lamp protection without objectionable shadows.



The fact that these guards have developed a steadily increasing demand, indicates their effectiveness.

A complete line of guards to fit standard brass and weather proof sockets to 1-5/8" diameter to effectively protect bulbs up to and including 200 watt pear shaped lamps. The reflector guards are made for lamp sizes up to 75 watt.

They are made with plain round head screws (FLEXCO) or key locking screws (FLEXCO-LOK).

A new guard which has recently proven very popular in our FLEXCO "Universal" which can be used for mill type or straight side lamps from 10 to 50 watt. It is adjusted at the collar with two bolts instead of plain screws and is made either in regular or reflector type. All FLEXCO "Universals" are adjustable to either brass or weather proof sockets to 1-1/2" diameter.

Still another, the split handle portable type guard has a very definite field in power plant operations, automobile repair work and elsewhere. Our line of these guards made in either regular or reflector type covers all ordinary requirements. Aside from the superiority of the construction of the guard, these lamps have split handles. This feature saves rewiring and time loss which is met when the handle is simply bored for the cord to pass through.



A Trial Test at Our Expense

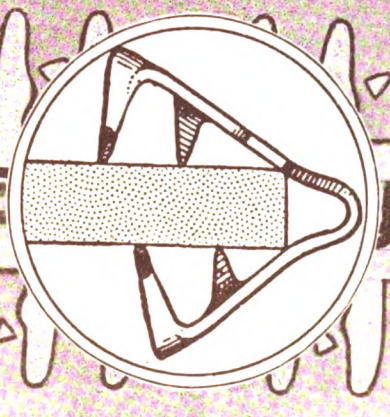
To any prospective user of our guards writing us on his company letter head before December 1st., we shall be glad to send with our compliments, a 50 watt size FLEXCO-LOK guard. State kind of socket used and if weatherproof, give diameter of socket at space next to or between shade holder rings.

Flexible Steel Lacing Co., 4639 Lexington St., Chicago.

ALLIGATOR

TRADE MARK REG. U. S. PAT. OFFICE

STEEL BELT LACING



The Modern Idea in Lacing

Old time lacings pulled against only part of the fabric. Modern Alligator Steel Belt Lacing pulls the entire fabric as a unit.

The teeth penetrate lengthwise and clinch down, each one a vise; binding the entire width of the belt in a grip of steel.

Alligator Steel Belt Lacing has every essential point of a perfect lacing; a tremendous reserve strength, quick, easy application, economy, an easily separable hinged joint no thicker than the belt. Smooth and flexible. "Just a hammer to apply it."

Made in complete range of sizes for belts of every material and thickness. Recommended and used in universal service. Investigate!

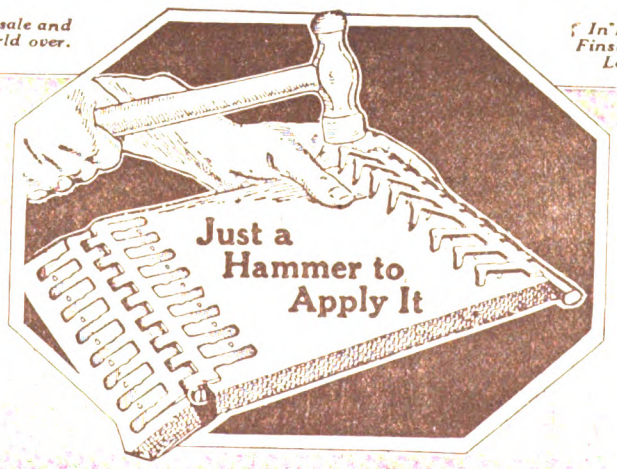
FLEXIBLE STEEL LACING CO.

4639 Lexington Street, Chicago.

Sold at wholesale and retail the world over.

In England at 135 Finsbury Pavement, London, E. C. 2

"Every Tooth A Vise"



For Every Size and Kind of Belt

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Industrial Americanization that Pays

(*Continued from page 15*)

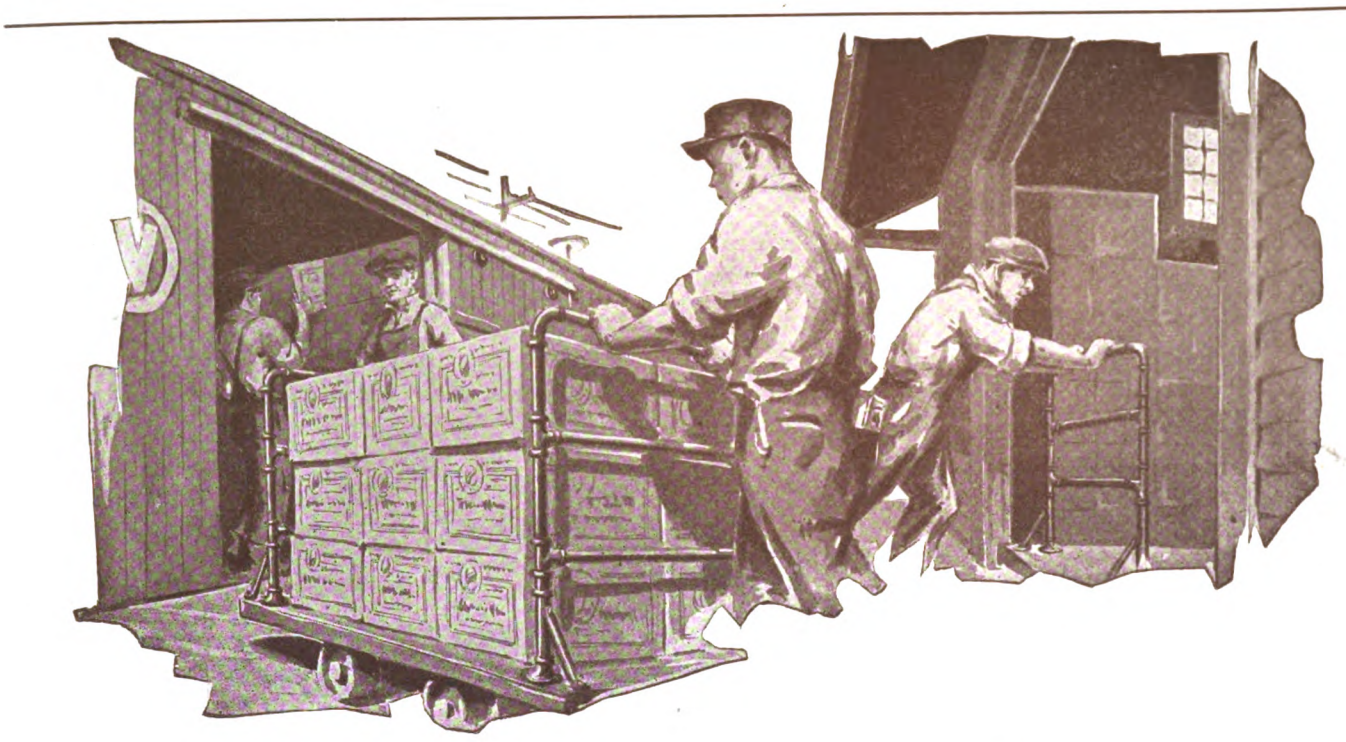
vaks and 3,000,000 Yiddish speaking people. Some of the largest foreign cities in the world are in the United States of America and three-fourths of the foreigners live in the cities. Huddled together in isolated communities they become an easy prey to grafters and agitators. Many have made good in America and others have been bitterly disappointed. They were met upon landing by unscrupulous exploiters of all descriptions. They were forced to live in unsanitary tenements. They were fleeced by padrones and fake employment agents. They were handled unsympathetically by bosses and foremen. They earned considerable money, but saved little because of high costs. They exchanged green fields for smoky steel mills and left beautiful cathedrals to be invited to cold churches or bare missions. Small wonder that they have not always overwhelmed us with expressions of gratitude and become citizens overnight!

Problems? Of course they present problems of ignorance and unassimilability. The illiteracy of Southern Italians is 54.2 per cent. of Croatians and Slovenians 36.4, of Polish 35.4; but some of them like the Czechs have a lower rate of illiteracy than us native Americans! It is true that they remain here on the average over six years before securing "first papers" and five years more before completing citizenship, but we must blame our faulty processes of education and our antiquated laws, partly at least, for that!

Opportunities? They are unlimited: To create right relationships between different racial groups and between these groups and native Americans; to promote social relationships on the basis of mutual acquaintance and appreciation; to appraise the contributions of different nationalities to human progress; to encourage sane methods of Americanization through goodwill, by living up to our ideals affording protection and fair treatment; and increasing coöperation and a respect for all races and colors! And, I repeat, this is to a large extent the task of industry.

New York State alone has more than 2,850,000 foreign born, only half of whom are naturalized. About 6,000,000 people live in New York City and 77 per cent. of these were foreign born or of immediate foreign descent. Amazing but true! But the situation is far from hopeless. Whereas 13.1 per cent. of all the foreign born in America are illiterate, only .8 of one per cent. of those of foreign parentage are illiterate, and this is a better showing than that of the native born whites (2.5 per cent)!

The big question before the country today is whether we shall have more or less immigration. Many industries complain of a labor shortage. Although our new restriction law allowed 357,803 to enter America last fiscal year, the quotas were not filled and many left



Good Boxes Pay

SHIPPING BOXES play an extremely important part in the ***profitable*** marketing of goods—and they should be chosen with the extreme care their importance warrants.

Between factory doors and the distant counters of dealers, stand "hurdles" that every shipper must meet. Numerous handlings of your merchandise by disinterested and none-too-careful hands—jolting trips in swaying freight cars—crushing pressure from piled-up merchandise—falls from platforms and trucks—these and a score of other potentially destructive factors lie in readiness to assail every shipment you make.
That is why ***only good dependable boxes*** should ***ever*** be used—and "H & D Service" is supplying more than forty millions of such boxes every year.

H & D Corrugated Fibre Boxes

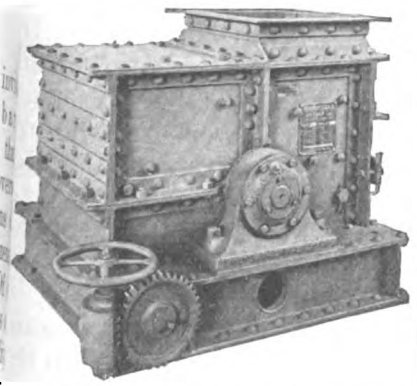
are justly famous throughout the shipping world for their rugged sturdiness, their absolute dependability and their unmatched economy. If you are interested in the cutting of your packing and shipping costs and want to improve upon your present boxes, let us lay the complete H & D facts before you. You will find the story of our free box design service particularly helpful. Write, or suggest to your box buyer that he get in touch with us.

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Send us the H & D Box Catalog and full details of your Free Box Design Service.
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The Hinde & Dauch Paper Co.
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The World's Largest Manufacturers of Corrugated Fibre Boxes and Packing Materials.

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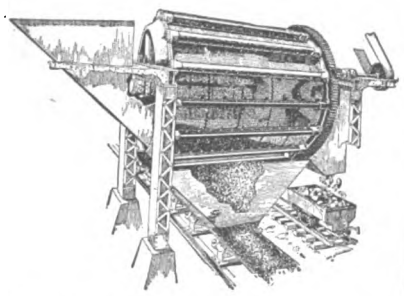


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39 Sizes

For Coal, Lime, Limestone, Shale, etc.

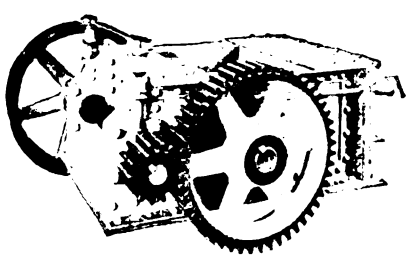
(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
(c) Oversize Bearings
(d) Patented Tramp Iron Separator
(e) Maganese Steel Wear Parts



BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY

Stephen Girard Bldg., Philadelphia.
New York Pittsburgh Chicago

here for Europe. Of those entering 32,724 were laborers, but over twice that number of laborers left the country! A special committee of the National Manufacturers' Association recently urged:

"1. That in fixing the quota of each nationality of otherwise admissible aliens under the present law, due regard should be given to ascertain annual emigration of such nationality. The Italian quota under the law last year was 42,000. Substantially 40,000 Italian immigrants entered the United States—53,000 emigrated. Thus, while the Italian quota was apparently satisfied, there was a large actual deficit. In other words, Congress should fix the quota in terms of net immigration.

"2. The Secretary of Labor should be authorized, upon the presentation to him of satisfactory evidence of a continuing shortage of labor of a particular class or type, to admit otherwise admissible aliens in excess of quota until in his judgment such condition is improved.

"3. Provision should be immediately made to provide for physical examination of aliens through a detail of United States medical officers at the point where passports are visaed or at convenient points of embarkation."

The Association also announced the following fundamentals for an immigration law:

"That the United States should retain the tests for mental, moral and political quality fixed in the law of 1917, except the literacy test, which we believe experience has demonstrated to be an ineffective means of determining the quality of an alien.

"That distinction be made between the above requirements for admission and those for naturalization, the latter requiring as a condition of citizenship a working knowledge of English and a practical understanding of the form and purpose of American Government and evidence of attachment to its principles.

"That the United States assert the right to register, distribute, educate and otherwise supervise the alien during the period of his alienage.

"That all immigration legislation be administered through



The man who led a triple life *in business*



W. J. SCHOONOVER
who multiplied his success by three and collected salaries from his other two selves.

WHEN Mr. W. J. Schoonover first saw an advertisement of this sort and sent for the little book "Forging Ahead in Business," which is offered below, he was thirty-five years old. He was treasurer of his own business, a glass warehouse in Scranton, Pennsylvania.

It seemed to him that he was as busy as a man ought to be, and that things were coming his way about as fast as they should.

That was seven years ago. Recently he wrote a letter about his experience with the Institute Course and Service which emphasizes several important points.

He was prepared to find the Course helpful, he says, but was surprised to find it so "interesting," so easily "understandable," and so directly applicable to "actual business situations."

The "direct result" of this Course

But the important paragraph in his letter is this:

"The direct results to me from the use of this Course are that I have been able to enlarge my business from one factory and office to its present dimensions of three factories and offices and, with the development of administrative ability, *I find that I can more easily handle the three than I formerly did the one.*"

With no strain, or effort—simply by developing his unused reserves—he had multiplied his business effectiveness by three.

Thousands have realized their opportunities

It would be easy to fill pages of this magazine with such letters. Sometimes they tell of enlarged responsibilities; sometimes of multiplied income; sometimes of the realization of opportunities that had previously seemed out of reach.

But the lesson of all of them is the same—business *does* pay its largest rewards to men who have business training; and opportunities *do* come to those who have the courage and self-confidence to reach out and take them.

The total number of men who have enrolled in the Alexander Hamilton Institute is now beyond the 200,000 mark. Of this, 27,198 are presidents; 8,294 are vice-presidents. *But* thousands were subordinates when they enrolled—department heads, accountants, engineers, salesmen, clerks.

Somewhere in this army is a man whose salary and position when he enrolled were precisely like yours. Isn't the experience of these other men evidence that this training is worth your investigation?

YOU can have the facts

Investigation is not difficult; the Institute welcomes it. It seeks to persuade no man; it asks only for an opportunity to lay the full facts before you. The facts are published in the 118-page book, "Forging Ahead in Business," which was Mr. Schoonover's introduction to the Institute, and has given a new direction to the business progress of so many other men.

The cost is nothing; the reward may be a new vision of your own powers which will enable you, as it did Mr. Schoonover, to triple your business capacity—to collect salaries from your two other selves.

Mail this Coupon today

Alexander Hamilton Institute
848 Astor Place, New York



Send me "Forging Ahead in Business," which I may keep without obligation.

Name .....
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a board composed of the Secretaries of Agriculture, Commerce and Labor, thus securing the coördination of the departments.

"That through the effective coöperation of State authority and private organizations, information as to immigrant needs and opportunities be compiled, analyzed and presented to the Federal Board, and further coöperation be established to present the economic needs of the nation in terms of ascertained fact, to protect the immigrant against exploitation, and secure for him accurate information as to existing opportunities throughout the nation."

Of course many objections can be raised against an increased influx of foreigners. It is a biological and political as well as an economic question. For years restrictonists have claimed a lowering of standards due to immigration, and for years the liberals have denied the charge.

There is comparatively little scientific data on the subject. Some claim that the position of American labor is not improved by restrictions, because the gaps are filled by negro agricultural workers who migrate to industries paying high wages, and by Mexicans. Over 14,000 of the latter entered through El Paso in six months!

In any case the vital question is how we can develop this country in the best way, rather than how we can develop it most rapidly. It is perfectly true that the majority of our recent arrivals have been females and old people, unfitted for hard unskilled labor. Those who suggested a solution of the problem by better distribution of immigrants are met by such a declaration as that of the recent Farmers' National Congress: "Resolved that we are unalterally opposed to the proposed diversion and distribution of aliens over the farming districts until immigration is rigidly restricted, numerically or otherwise."

Whatever side we take on this matter of the open or closed door there can be no argument against a comprehensive, fair-minded program of Americanization for those who are here now and others who are coming!

As Professor Frederick Davenport well says:

"The best way to prevent the dangerous growth of hate, violence, direct actionism, the general strike, dictatorship of the proletariat, communism and all the other dreaded phenomena of unbridled mass action, is just to be human, and let every worthy alien feel and know that government and law and justice in America are on his side just as they are on ours."

And remarks Allen T. Burns:

"Americanization has been considered as the union of native and foreign-born in all the most fundamental relationships and activities of our national life. For Americanization is the uniting foreign with native-born Americans in fuller common understanding and appreciation, to secure by means of self-direction and self-government the highest welfare of all."

I reiterate, this is to a large extent the task of industry! There is no good reason why

(Continued on page 66)

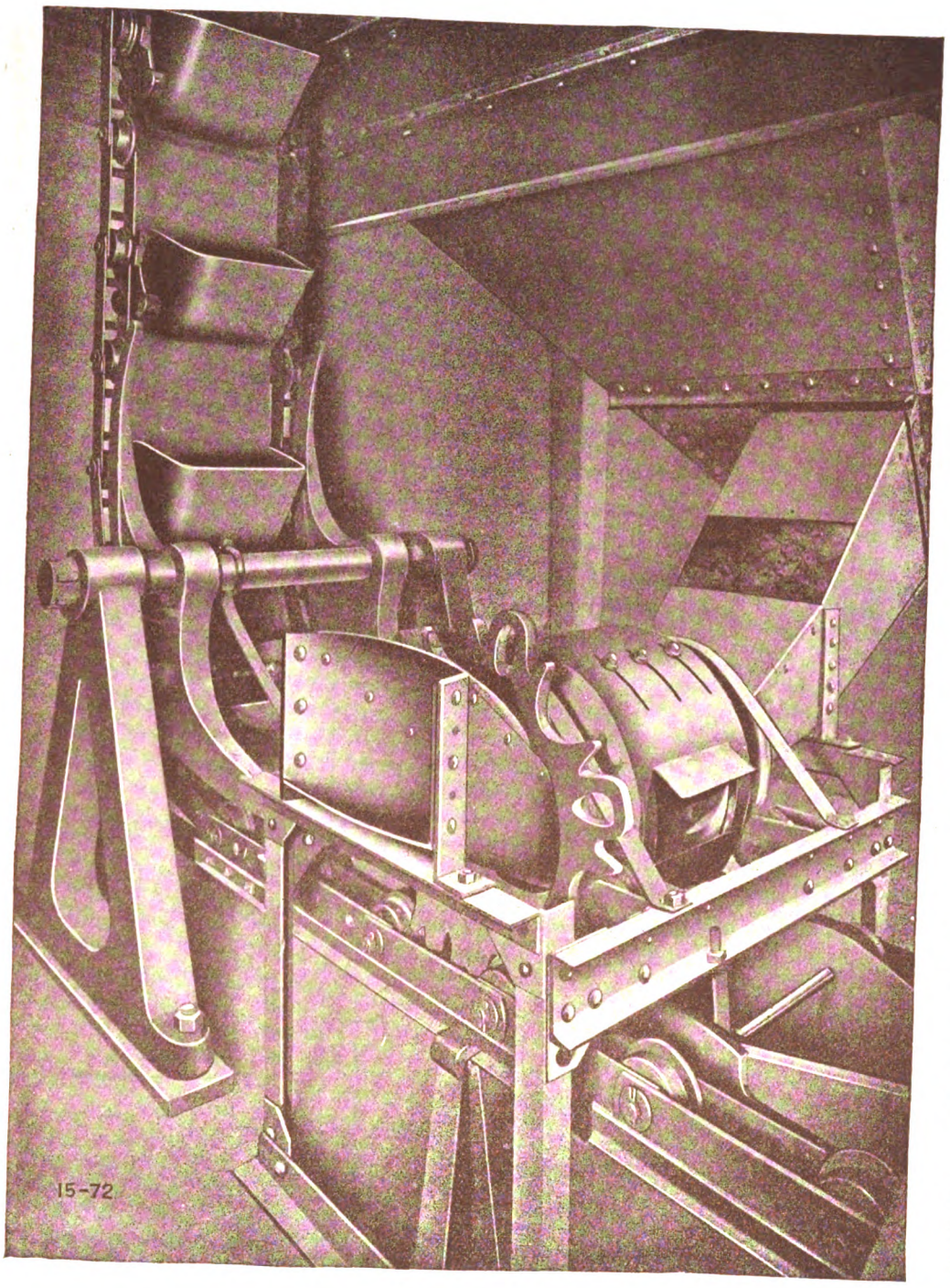


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Cost, more than *Price*, Fixes Profits!

"Many Manufacturers depend on their balance sheets to determine costs," says E. St. Elmo Lewis, in his book "Efficient Cost-Keeping." And, he further states "This is guesswork of the rankest, most treacherous sort."



Hunt Pivoted Bucket Conveyor, showing Filler and fixed curve for cramped quarters.

The buckets are loaded by a filler of the revolving drum type, which is driven from the conveyor chain through a wheel designed to properly engage in the links of the chain. The filler moves in perfect synchronism with the conveyor and gives an equal charge to each bucket, filling each bucket to capacity without spilling the material over the edges or between the buckets. It furthermore prevents dust and grit from getting into the working parts of the conveyor.

This is a stern arraignment of the manufacturer; and unfortunately in a majority of cases it is true. Too much credence is placed on ***"paper costs"*** and not enough on actual data; the result is a wilderness of figures that mean nothing but as Mr. Lewis says, "guesswork of the most treacherous sort."

If your coal and ashes handling costs are excessive,—due to obsolete or unsuitable machinery, faulty systems, or wheelbarrow pushing methods,—they impose a burden that has to be dragged through the entire gamut of costs to the ultimate selling price of your product thus affecting the profit thereon.

Few executives realize that coal and ash handling costs have such a bearing on the profit, but it is nevertheless true; and the greatest care must be exercised in choosing such apparatus for performing this vital operation as will reduce to the minimum these charges.

Hunt Cost-Cutting Equipment has a long record of efficient, economical, time-saving service extending over half a century. A wide variety of industries is represented among users of Hunt Coal and Ashes Handling Machinery; the installations in service ranging from 18 to 35 years with few repairs.

Hunt Engineers with over half a century of experience and a vast amount of practical information accumulated in that long period, are ever willing to help plan a handling system for coal and ashes and other bulk material that will prove satisfactory in every way.

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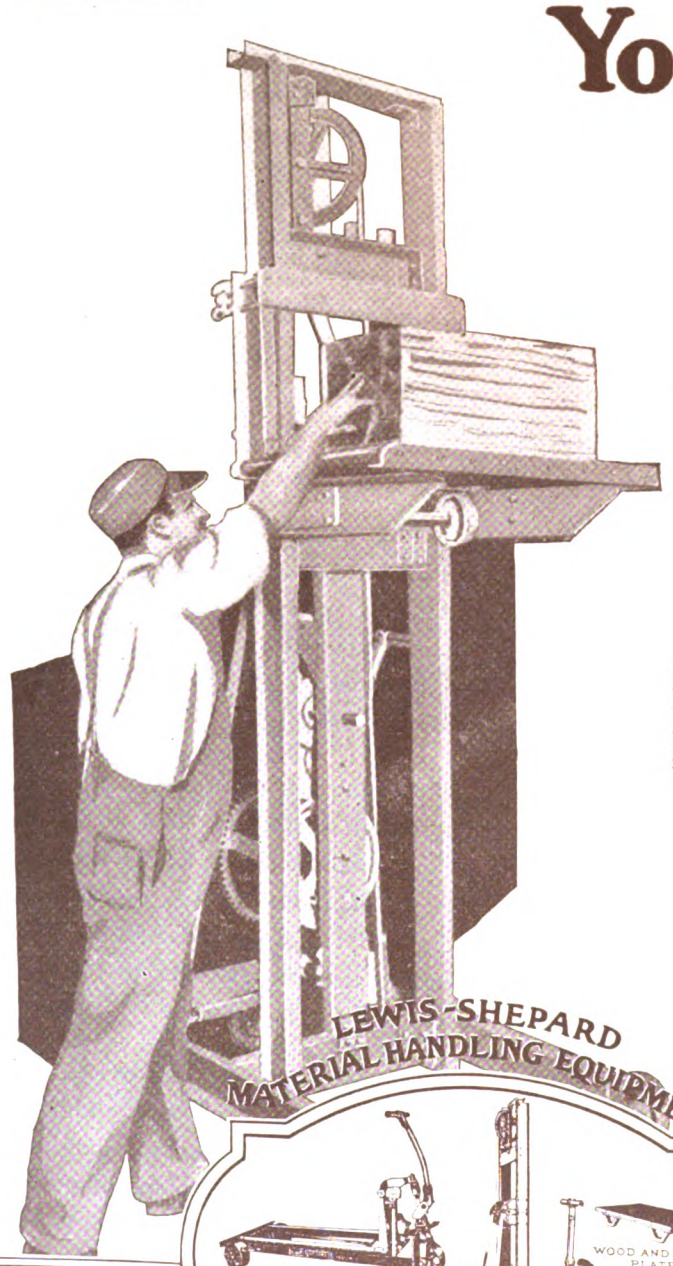
(*Continued from page 64*)

every plant employing any considerable number of foreign-born should not organize a cosmopolitan Americanization Committee. With the help of this Committee there can be promoted pageants, dramas, song contests, exhibits of foreign handicrafts, folk dances, concerts, athletic demonstrations and celebrations of foreign holidays which will afford opportunity for self-expression and help interpret foreign and American born to each other.

In some ways these activities are even more important than the customary classes and clubs in English and citizenship; health, safety, thrift, clean-up, gardening and other campaigns; noon recreation and athletic leagues; foreign boys' and girls' clubs and outings; shop meetings, lectures, movies and entertainments; legal advice and counsel on safe investments; observation trips to points of historic and civic interest; community parties and socials which bring foreign and American-born together. All these and many other activities constitute an *all-year program of shop Americanization.* Often foreign societies and periodicals, churches and schools, Y. M. C. A. and Y. W. C. A. can coöperate to the greatest advantage. The last two organizations have a world program of service which assists immigrants in countries of origin, frontier towns, ports of embarkation, on shipboard, at chief ports of entry and at final destination. Years of experience and familiarity with best methods make them valuable assets to any industrial operation.

Emigration is the safety valve of some of the countries of Europe. *Americanization is the safety-valve of many industries in America!* In 1861 the problem was to save the nation from being "half slave and half free." In 1923 the problem is to save the nation from being part foreign and part American. Industrial Americanization will be possible not through distasteful compulsion but through generous coöperation, a full regard for the traditions, history and ideals of our racial groups, an increasing emphasis on the importance of the human factor, a program of hospitality, protection, friendship and service and a growing mutual understanding between employer and employee and between foreign and native born!

Are You Making the Profits You Should?



Sooner or later you will make this profitable discovery—that Lewis-Shepard Jacklifts, Stackers and Platforms *save* more men and cost less money than any other labor-saving products on the market. Over 600% Profit in One Year! Why delay the discovery.

Just write—and one of our experienced sales engineers will call. With no obligation on your part, he will show you how you can save both men and money with Lewis-Shepard Equipment.

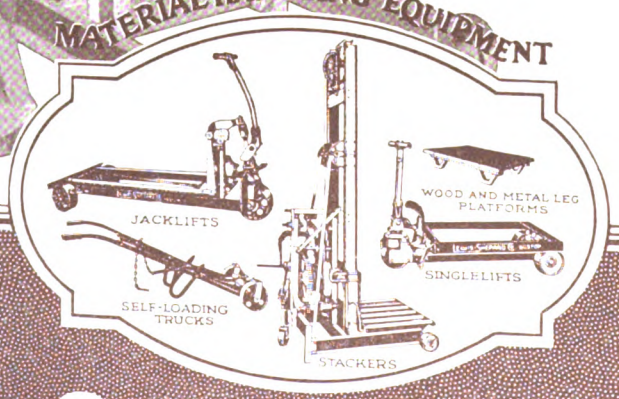
"No Advance in Prices"
The L-S Slogan

Write us today at our factory address

Lewis-Shepard Co.
582 East First St.
Boston, Mass.

Canadian Fairbanks Morse Co., Ltd. "Distributors for Canada."

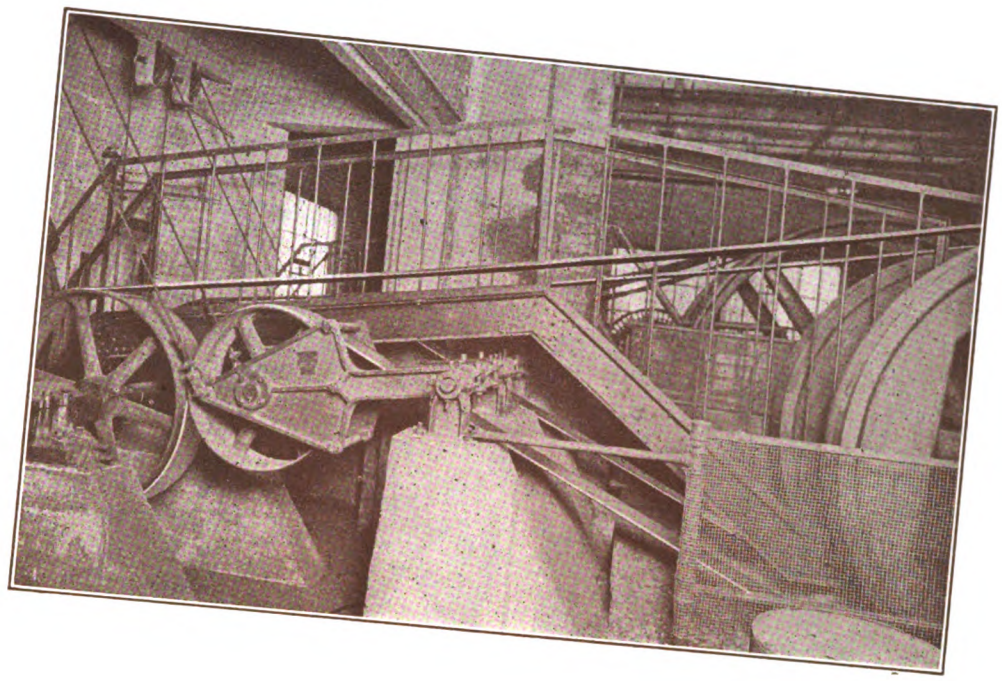
Branches in 22 Principal Cities



Lewis-Shepard
BOSTON

A report on industrial accidents in the United States has recently been issued by the United States Bureau of Labor Statistics as Bulletin No. 339. About one-half of the report deals with these data in an attempt to show what can be gathered toward a presentation of the accident situation on a national scale. So far as possible the record has been arranged on a uniform classification of industries, cause of injury, nature of injury and location of injury. Unfortunately lack of information regarding the amount of exposure in the various industries renders this body of information very much less significant than it otherwise would be.

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Point Number Two — "Belt Tension"

One of the most difficult problems confronting the operator of a belt drive is to maintain the proper belt tension. This is usually done by moving the motor on its slide rails, or, if there is an idler, by increasing the idler pressure on the slack side of the belt. The tension thus applied is of an unknown degree, guessed at by the man on the job. Overnight changes in temperature and atmospheric conditions add to or subtract from the tension applied in this manner.

What is the result?

It is that the tension in the belt of an open or common idler drive is in nearly all cases much greater than necessary to transmit the load. This means that there is an unnecessary, increased bearing pressure with consequent excessive friction losses of long duration, or the loss of a burned out bearing or motor.

Not so with the *Lenix Drive.*

In the installation illustrated there are two compressors each with two overhung flywheels and two belts, driven from a lineshaft through Lenix Drives. The shaft is turned by a 200 HP motor with a Lenix Drive.

One year of costly experiments proved this installation could not be operated without the Lenix Drive. Without changing the design of the compressors it was necessary to apply two three-ply belts in parallel to each unit.

No two belts of the same specification will stretch to the same degree. Open belt drives could not therefore be employed. With the two Lenix Drives working in Parallel the load of each unit is nicely divided between the two belts and, if necessary, can be adjusted with the drive running. The periodic, wide variation in the power demand of these multistage compressors which caused the failure of metallic and unelastic drives is automatically compensated for by the Lenix and the elasticity of the leather belts.

Booklet, "Saving Slippage and Space" tells how is it done. Send for a copy.

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

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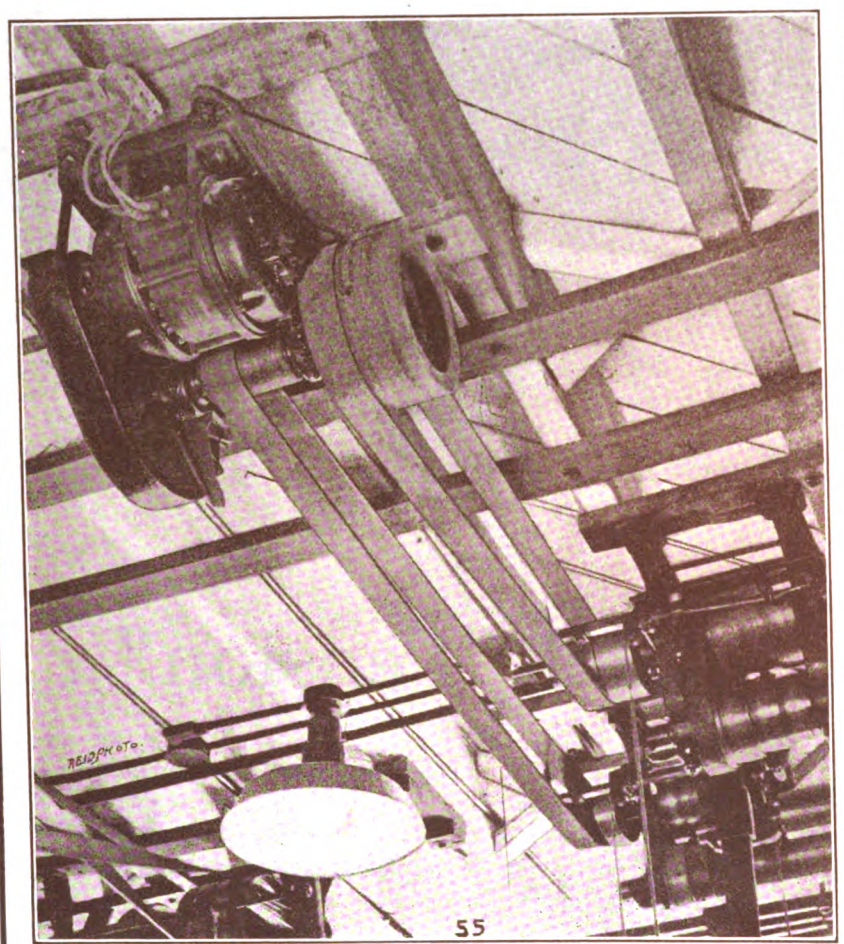
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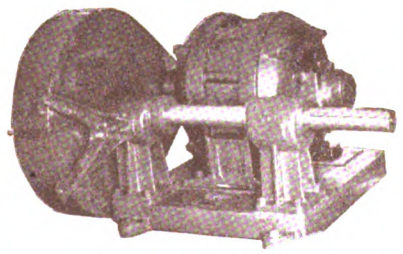
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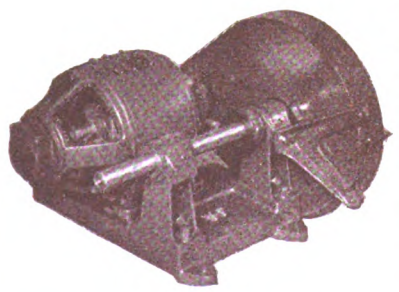
Driving Two Countershafts at Different Speeds



Furnished as Standard Equipment by the better Motor Manufacturers.

Here is another example of the successful application of Watson-Flagg Reduction Gear Drives.

This particular unit has been approved by the Norton Company and will be furnished as optional motor drive equipment for Norton universal tool and cutter grinding machines.



W. F. Reduction Gear Drives have solved many difficult transmission problems. They will fit any make of motor. Perhaps the solution to your problem is just as simple as the above.

WATSON-FLAGG

ENGINEERING COMPANY

PATERSON, N. J.

Good Housekeeping in the Modern Plant

(*Continued from page 26*)

What is good factory housekeeping? Good factory housekeeping in accident prevention bears the same relation to the shop as the thyroid gland does to the other glands—it is the master gland. Good housekeeping does not mean to rouge the shop, but it does mean to keep it free from debris and the aisles free from obstruction. Ladders should be looked after to see there are no rungs missing. Broken or weak ladders, or ladders with missing rungs should be destroyed. It is recommended that ladders be equipped with metal points or lead coated bases for wooden boors. Carborundum bases for the use on iron floors. Pivoted lead shoes of carborundum are recommended when ladders are to be used on concrete floors, and recessed rubber bases when used on wet floors.

Among the hazards of the machine shop, which might be and usually are productive of serious accidents, are oily floors, and floors littered with rubbish, scrap and raw material. One factory employing a thousand persons considered $10,000 a year spent in keeping the factory clean a good investment. The manager of this concern is of the opinion that safety and cleanliness are analogous. This concern prides itself on the fact that not one of the men has incurred a puncture wound to feet in the past five years. The projecting nail hazard in this factory has been entirely eliminated, due to good factory housekeeping. A great percentage of those accidents which are attributed to carelessness are unquestionably due to poor factory housekeeping.

Obstructed or crowded aisles are prolific causes of accidents not only to truckers, but to employees whose work is situated near the aisles. In plants where machines are placed close together the accident rate is invariably higher than in those in which ample space is provided. Safety aisles should be laid out, with "dead lines." One aisle should be utilized for "Up Travel" and one for "Down Travel." Each truck should be equipped with a horn or bell to warn of its approach. Safety aisles should not be less than eight feet wide. The internal transportation of material presents a serious hazard.

Defective tools and appliances are always a source of injury to workers. Broken hammer handles, wrenches, chisel handles, screw drivers, mushroom headed hammers all contribute their quota to the accident list and are good illustrations of poor housekeeping.

Inadequate illumination rightly comes within the purview of poor housekeeping, and is responsible for an annual cost of nearly $300,000,000 due to accidents. As regards the immediate effect of lighting on output, the industrial commission of Wisconsin found that a steel plant, just by changing its system of lighting, could increase its output at night over ten per cent.

An English concern found that the efficiency of the workers gained from five to fifteen per cent. after the factory windows had been cleaned. Dark, dirty walls and ceiling do not reflect light; they absorb it.

Defective ventilation is also responsible for many industrial accidents, since extreme fatigue may be superinduced by poor ventilation.

Recently a survey was made by Dr. H. M. Vernon, of the British Industrial Fatigue Research Board, to determine the optimum temperature with regard to accident immunity. He found that accident frequency gradually increased with decreasing temperature, until at 52 degrees it was 35 per cent. greater than at 67 degrees. "At 47 degrees it was rather less than at 52 degrees, possibly because the workers reduced their rate of production and thereby ran less risk of accidents. At temperatures above 67 degrees the accident frequency increased rapidly, until at 77 degrees it was 39 per cent. greater than at 67 degrees. In all probability a temperature of 67 degrees is too high for the maximum efficiency of workers engaged on fairly active work."

A series of experiments conducted by the New York and

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Chicago Commissions on ventilation showed man's greatest efficiency is between 60 and 68 degrees Fahr.

The customary figure of 70 degrees Fahr. for the atmosphere in even ordinary occupations, in which there is little physical activity, has been experimentally demonstrated to be physiologically harmful.

To reduce the temperature to 60 degrees in shops and offices would do much to cut the high cost of living by saving in coal and increasing the workers' output, and lessening sickness. Practically no discomfort will be experienced in a room in which the temperature is 60 degrees, provided the humidity is kept around 50 degrees.

The New York Commission on Ventilation found that when they kept rabbits in a temperature ranging from 80 to 89 degrees, their resistance to disease was greatly lessened thereby.

The effect of hot and cold air on the lining membranes of the nose and throat was also investigated by this commission. They found that heat caused increased swelling, redness and secretion in the nasal membranes, which rendered a person more susceptible to colds.

Unquestionably, the prime requisite for lessening accidents is good housekeeping. Safety engineers generally agree that no more than 20 per cent. of the industrial accidents can be prevented by safety devices or any kind of mechanical equipment.

In plants where considerable guarding has already been done, the analysis of the accidents which still occur will show that they are the result of poor housekeeping.

A good illustration of poor housekeeping is the removal of guards from machines by workmen. A visit to any machine shop will show several machines, which have been guarded in conformity with State or Insurance requirements, but have been removed by workmen.

Grinding wheels are a constant source of danger. The hazard of bursting grinding wheels has long been recognized. Effective guards have been designed to minimize the effects of broken wheels; glass shields have been placed over the wheels to protect the worker's eyes from flying sparks. These guards are of no value unless they are in place, and one of the functions of good housekeeping is to see that they are not removed.

One industrial manager has found good housekeeping so productive of good results he has what is known as "Inspection Day," twice a year. During "Inspection Day," the families of the employees are invited to visit the plant and inspect the working conditions, under which the member of the family is working. They are permitted to roam around the factory and grounds, and inspect every nook and corner. After the inspection, motion pictures are shown and refreshments served. Inspection Day has done much to stimulate and sustain interest in good shop housekeeping, and as a result has accomplished a great deal of good in this shop. It has done much to cement good relations between the factory and the family of the employee.

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Speeding the Family Wash

(*Continued from page 19*)

washables and then ironing them. Most of that string of epithets apply even when the job is done by electricity, laundress or just plain washerwoman.

Against the background of a lifetime of blue Mondays it looks all wrong, like a scene from Alice in Wonderland, to see men and girls at work in the Pilgrim Laundry of Brooklyn, N. Y., whose selves and surroundings look as though they might be baking cakes or making candy, and be told they are doing not one, but a hundred family washings at a time! Spotless white overall uniforms, well groomed heads, hands and feet, daylight everywhere, no slippery, sloppery floors, no steam clouds! More women ought to see the modern laundry. And more women's husbands ought to see it, too, as an object lesson.

This is not going to be a tedious description of how a laundry sorts and washes clothes, but just of the exceptional way in which the Pilgrim Laundry handles them, moves them from place to place, from operation to operation, from floor to floor. The conveying system in this plant is said to be the largest and most complete in any laundry of the country. So much of a pioneer is it that parts of it had to be built experimentally and the rebuilt after a trial. The laundry managers and the conveying engineers are studying its operation with a view to improving its performance of present duty and to still further "conveyorizing" the plant when certain enlargements under construction shall have been completed.

Very little man-power carrying seems left to eliminate. The bags brought in by the drivers, each containing a customer's wash, are dropped from the wagons into canvas trucks which are pushed by hand perhaps 25 feet to the elevator and from there, on the third floor, are again pushed by hand a distance of about 35 feet to the point where the bags are opened for classifying their contents. Thereafter practically all movement from one operation to the next is by conveyor.

The variety of the conveying mechanisms, their locations and their combinations, is interesting and ingenious in the highest degree. There are belts whose movements in both directions are utilized. There are gravity rollers and gravity slides. There are power conveyors that carry horizontally, vertically and on an incline. There are light, straight wire lines, like the cash carriers in stores, used to shoot tags and tickets where they will meet the work at the wrapping tables. They stand on the floor, they hang from the ceiling, and slides and spirals go through one floor to the next.

At one point a neat problem in planes and directions is solved by an over-and-under, over-again - and - under - again arrangement, just as the engineers who built the Hudson Tubes, where there must needs



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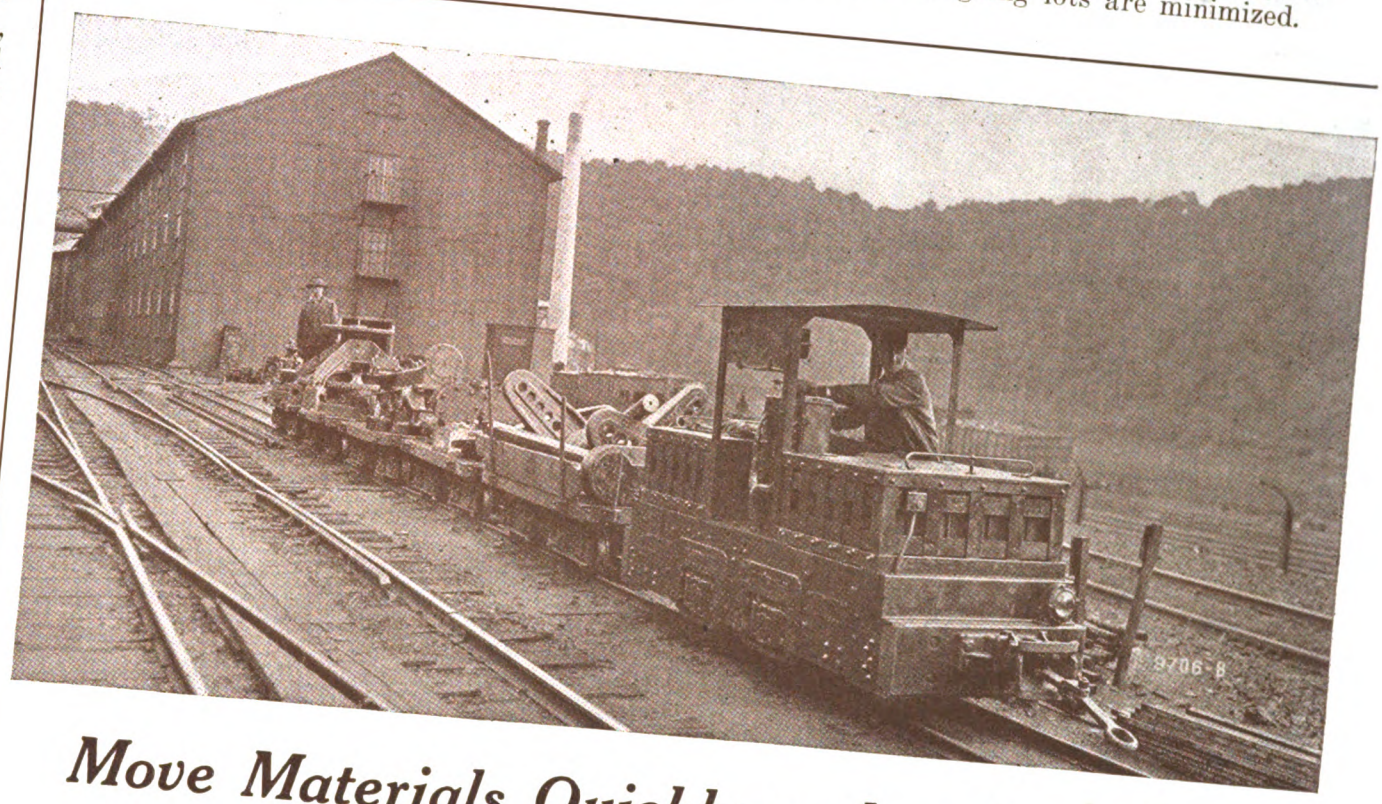
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be several complicated crossings in Jersey City, avoided making them at grade by entwining the tubes over and under each other like gigantic twisted lines of fire hose.

Do not get the idea that there is confusion in this varivet. The conveyors are not in the way of any worker or machine. The workers do not have to do any thinking or selection in using them. They constitute a circulating system and the variety is its adaptation to the work at each point, the operation to be performed just there, and the movement of the work to the next in line. The net result is that everybody's work is at his elbow as fast as he is ready for it, at the most convenient height and distance to save fatigue, confusion and loss of time without crowding on high speed. And when the operation is over, passing the work on to the next worker requires no more effort or loss of time than picking it up did. For example, the criss-crossing spoken of a minute ago could have been avoided by having half the apparatus at a height which would give a sufficient slope for all-gravity movement. In fact, at first it was constructed in that manner. But that necessitated an overhead lift on the part of the girls working at that point, so, on account of the human element, down they came to 12 or 14 inches from the floor, even though the engineers had to tie knots in the long lines of rollers and insert an inclined power section to get the load up to the high level.

In laundries not equipped with such complete mechanical circulation, each lot of clothes after each operation must be dropped into a truck. Each truckload must then be pushed along the floor to the next operation either by one of the operatives or by a porter. That movement, winding in and out among the machinery, necessarily must be slow, and the lanes which must be left open for trucking take up much floor space. Every time there is an obstruction in those lanes, trucking is stopped or at least retarded and, in turn, workers and machines are held up. Conveyors move at a constant, predetermined speed, timed so that work neither piles up at one point, nor is tardy in reaching other points so as to cause idle minutes there. Floor space occupied by the conveyor is but a little over half the width of a truck, just wide enough for a single bundle or lot, since they are instantly carried along out of the way as they are dropped on. Nobody ever leaves an obstruction on a conveyor to get in the way of its movement. There is no stooping and lifting as is required to load and unload a truck. And there is no waiting or calling to a possibly sick, temperamental or absent porter, to hurry up.

Apart from time, space and labor saving on specific operations, the outstanding advantage of conveyorizing comes from the operation of the system as a whole. This is its synchronizing effect upon all operations. It results in smooth working of the lot system whereby the several classifications of each customer's laundry, each receiving different suitable treatment, arrive at the assembling point in the shipping room so nearly together that confusion, errors and piling up of incomplete outgoing lots are minimized.



Move Materials Quickly and at Low Cost

HOW to move materials in the least time and at least expense—is a big problem around many industrial plants—others have solved it by installing **Jeffrey Electric Locomotives.**

One industrial plant saved $8000.00 the first year with their Jeffrey Industrial Locomotives—a few cents saved on every ton hauled in your plant would add up a large total in your yearly saving—wouldn't it?

Jeffrey Electric Locomotives—both storage battery and trolley type, are rugged in construction, embody latest successful engineers' practices, and move their loads at exceedingly low cost regardless of severe service or weather conditions.

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Combining a Water-Supply and Power Development

(*Continued from page 21*)

pushed along with energy and speed. It is said that for many years to come the demand for power will keep pace with new sources of supply.

It will be desirable, in order to get a clear view of the power development, to have before us a fair understanding of the general enterprise.

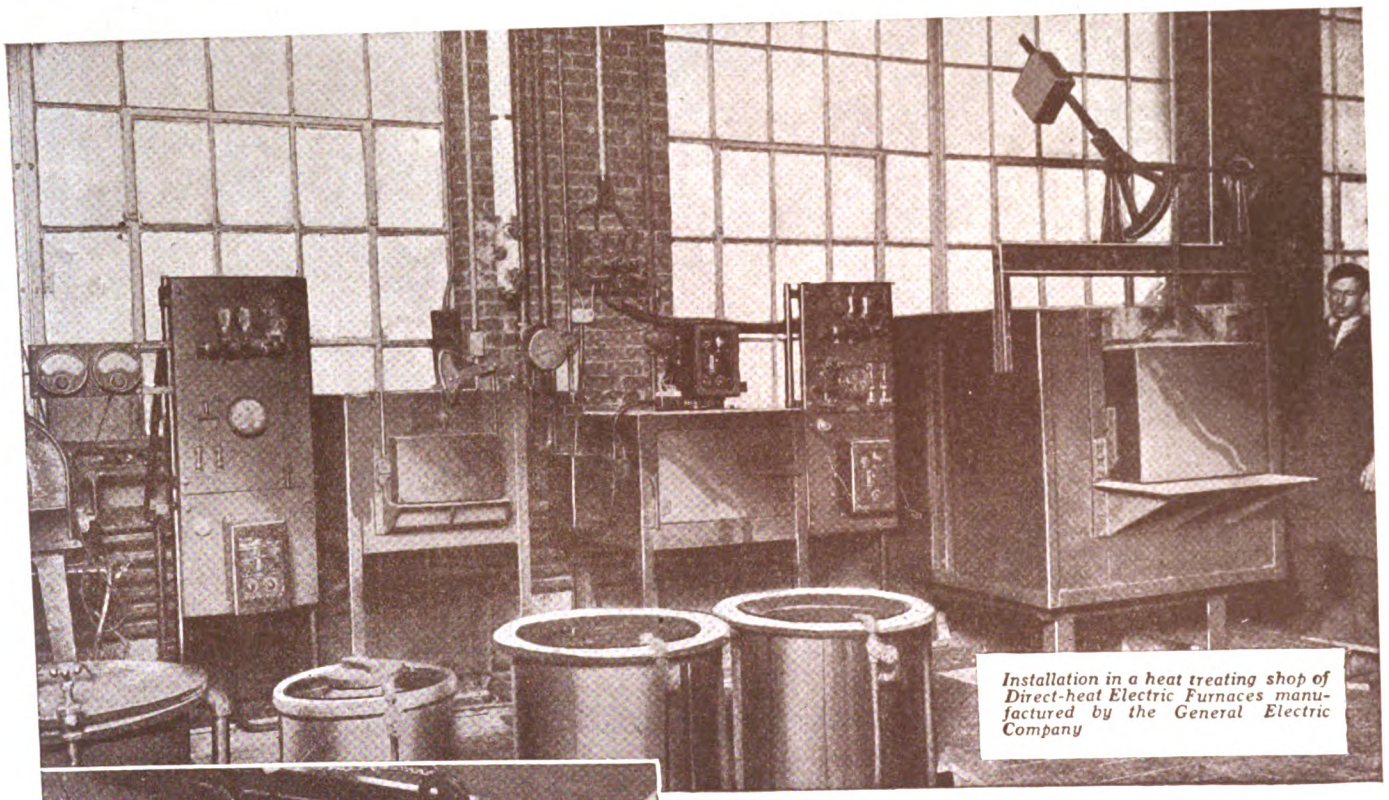
The Hetch-Hetchy Water Supply Project is expected to be competent to the needs of San Francisco and the adjacent metropolitan district for the century ahead. In so far as water is concerned. The capacity of 400,000,000 gallons per day covers this matter. In addition, there is to be a power development of something like 250,000 horse-power. The hydro-electric feature is an incidental of the main project. But, for the immediate future, it becomes the ranking element. The water for the great enterprise is to come from the Tuolumne River and some of its tributaries. The general location of the source of supply is 150 miles from San Francisco high up on the western slope of the Sierra Nevada Mountains. The chief site for reservoir use is in the Hetch-Hetchy alley. We have here the source of the name given to the project.

Ultimately, the great Hetch-Hetchy Dam will impound water, in the reservoir of similar name, to the enormous total of 113,000,000,000 gallons, enough to feed the aqueduct at capacity for one month. The watershed which will gather this water has an area of 459 square miles. Measured along the aqueduct route, the distance of this district from San Francisco is 170 miles. The level of the water in Hetch-Hetchy Reservoir which properly filled will be 3,800 feet.* Lake Eleanor is another reservoir on the distant slopes of the mountains. The watershed is not large, having an area of only 79 square miles. However, the reservoir capacity may be pushed up to 54,000,000,000 gallons.

Both the Hetch-Hetchy and the Lake Eleanor watersheds lie within the confines of the Yosemite National Park. But they are not within the Yosemite Valley itself. This wonderful valley is eighteen miles to the south-east of Hetch-Hetchy. It is in the drainage basin of the Merced River and is entirely unaffected by the water supply development with which we are occupied. Cherry Creek is a distant source of water whose valley lies in the Stanislaus National Park. It is to be made to deliver its water to Lake Eleanor. This is to be accomplished by means of a special aqueduct and tunnel. There are quite a number of small reservoirs in contemplation that I do not mention, but which may be developed later on as occasion occurs.

The flow line of Lake Eleanor, as this reservoir may

* This means 3800 feet above Hetch Hetchy Datum. To get U.S. G.S. Datum, subtract 1.25 feet.



Installation in a heat treating shop of Direct-heat Electric Furnaces manufactured by the General Electric Company



Heat treating furnace equipped with G-E Direct-heat Units and Automatic Temperature Control

Electric Heat Treating With G-E Equipment

The General Electric Company manufactures Direct-heat Electric Furnaces, complete in standard sizes, and Direct-heat Units to equip electric furnaces of larger sizes—meeting the requirements of heat treating processes of any nature in industry today.

The heating unit, located in the furnace chamber, radiates its heat directly to the charge. This produces rapid heating, and permits of quick changes in temperature when desired—and insures uniform temperature throughout the chamber.

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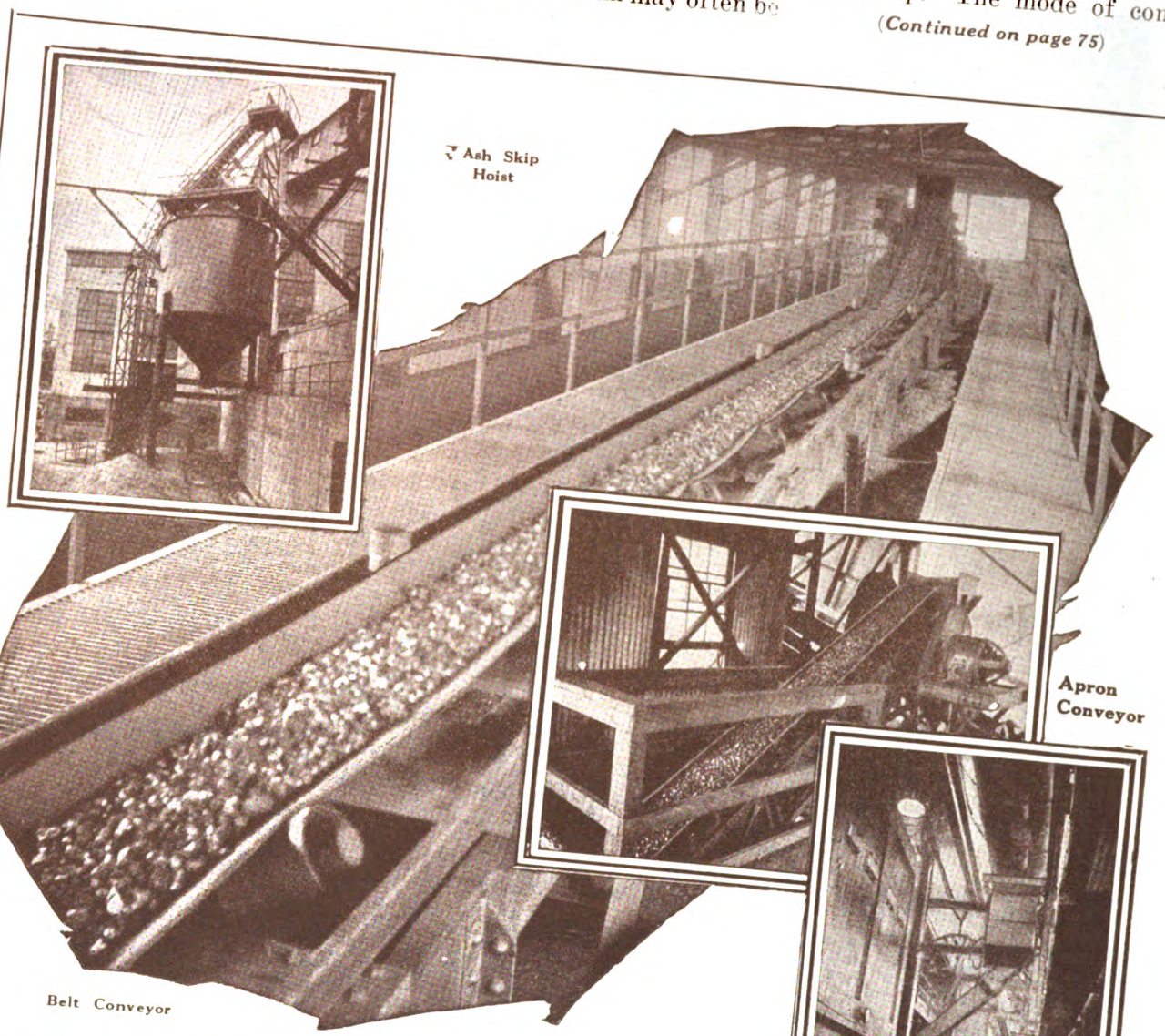
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be developed, will be one of the highest. That is, the surface will be at about Elevation 4715. This is an elevation suitable for a very respectable mountain. At least it would be so considered in the Eastern States. The watershed region that is to be tributary to the Hetch-Hetchy development has a total area of 652 square miles. Its elevation above the sea varies from 3,500 at Hetch-Hetchy to 13090 feet at Mt. Lyell. In fact, some 92 per cent. of the area is above the 6,000-foot level. No permanent habitations are located within the region and there are sanitary regulations which control the contamination of the water by parties camping in the summer time. In short, San Francisco and the vicinity have in prospect, it would seem, an abundant supply of very pure mountain water.

One of the chief construction features of the great enterprise is Hetch-Hetchy Dam. Ultimately, the height above stream level is to be 312 feet. The plans now being carried out, which have in view the rapid development of hydro-electric power at this point, will be satisfied with an initial height of 226 feet. That reduced height will nevertheless develop a capacity of about 66,000,000,000 gallons. This will be, say, three-fifths of the ultimate possibilities of storage. A considerable lake will be brought into existence one having a length of 7½ miles and an average width of one-third of a mile. At the maximum breadth, the width will be double the average. There will thus be a new sheet of water in this district with a surface area of 2½ square miles. The ultimate development will not add greatly to the figures as to the lake, the increased capacity arising mostly from the added depth. Hetch-Hetchy Dam will at the beginning have a length along the crest of 600 feet. Ultimately, this dimension will be increased to 900 feet. The amount of concrete masonry in the dam when initially completed will be 400,000 cubic yards. Later, an addition bringing the total up to 660,000 cubic yards is to be made. The dimensions of Hetch-Hetchy Dam, both for the initial structure and for the ultimate work, are such as to make it a very notable example of concrete construction carried out on an elevated site.

The dam is to have what is known as a gravity section. That is, it will be given a varying thickness increasing with the depth, and consequently the horizontal thrust, of the water. A plan view of the dam would disclose an arch, the concave side being downstream. The dam will accordingly resist the thrust of the water on the upstream side both by its weight and by the arch action due to its form. The use of arched dams has become common in recent years. In fact, if the canyon is wide, what is known as a multiple-arch dam may often be constructed. The structure at Lake Eleanor, which is nearly or perhaps entirely completed, is of the multiple-arch variety. However, with a plurality of arches, the upstream faces are inclined to the vertical, the inclination being directed downstream as one views them from below up. The mode of con-

(Continued on page 75)



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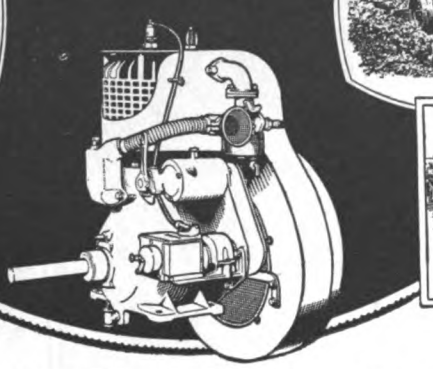














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(Continued from page 73)

struction enables many dams to be built with less concrete than if a gravity section were employed in the design. The reason underlying this economy of material centers on the fact that the tilt enables the arches to transfer the thrust of the water to the foundation of the dam. At Hetch- Hetchy, however, the arch is a single one and the upstream face is vertical as well as convex. The foundation is naturally the bedrock. The lowest point is at elevation 3382.5 and the maximum thickness of the concrete dam put upon it is 310 feet. The initial dam will rise 344 feet above the lowest point and will accordingly not be so much higher than it is thick at the maximum point. When the dam is, later on, brought to its full height, no addition to the great bottom mass next the rock will be required. That is, the full body of concrete up to the stream-bed level (El. 3500) will be put in place at the beginning. When the dam is to be continued on up to its full height, the section will be added to on the down-stream face and the concrete above the initial crest will, on the upstream vertical face, be in line with the initial structure.

Ultimately, Lake Eleanor will be outranked in the present enterprise only by Hetch-Hetchy Reservoir itself. A part of the necessary dam has already been constructed. This will form the toe of the structure that is to be eventually built. That is to say, the present dam is of quite moderate height, but later on this structure will be added to and the height and base increased. It was desirable to use a design permitting rapidity of construction for the initial dam, and at the same time avoid any considerable transportation of material. These considerations weighed in the selection of the multiple-arch type of dam. The single arch type was out of the question. The dam constructed has 20 arches each of 40 feet span. They constitute the multiple arch dam proper. Then there is a total of 460 feet of gravity wall, 200 feet being spillway. There is a log chute in the gravity section of the dam, through which logs may be passed to the lower level. The upstream face of the multiple-arch section presents a most unusual view. Here are twenty big cylindrical surfaces leaning over in the direction of flow at an angle of 50° to the horizontal. A notable detail consists in the fact that the barrel of the individual arches is not a circular cylinder. It is the horizontal section whose outline presents a circle and not the section perpendicular to the axis. The great stretch of "leaning towers" are individually surmounted by vertical faces seven feet high.

The Hetch-Hetchy Dam impounds an extensive body of water, as has already been pointed out. In accordance with the plans for the initial development, the water released from this great reservoir will flow down the mountain sides for a distance of twelve miles and will utilize the natural channel of the Tuolumne River. The change in level accomplished by the river in this distance is 1,160 feet. Later on, this drop is to be developed into electric en-

(Continued on page 77)



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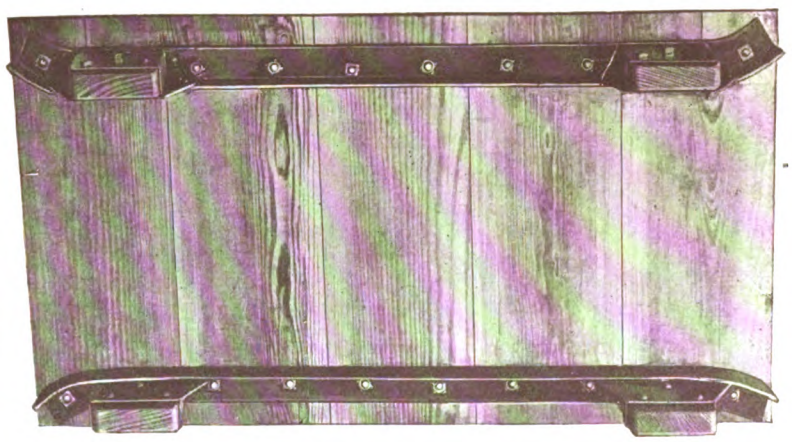
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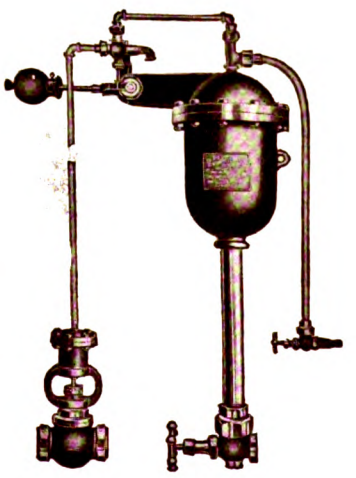
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(Continued from page 75)

ergy. That is to say, a tunnel aqueduct is to be constructed in the granite wall of the canyon on the southern side of the river and, in connection with this constructional feature, the hydraulic drop will be utilized. At first, however, the water from the Hetch-Hetchy Reservoir will flow through the twelve-mile natural channel to a diversion dam at Early Intake.

The portion of the aqueduct that is now being built begins at Early Intake. A canal one-half mile long leads from the diversion dam and provides a group of settling chambers. Next, the aqueduct water will be led through a great tunnel 18.3 miles in length. Emerging from this tunnel, the water will flow into the regulating forebay at Priest.

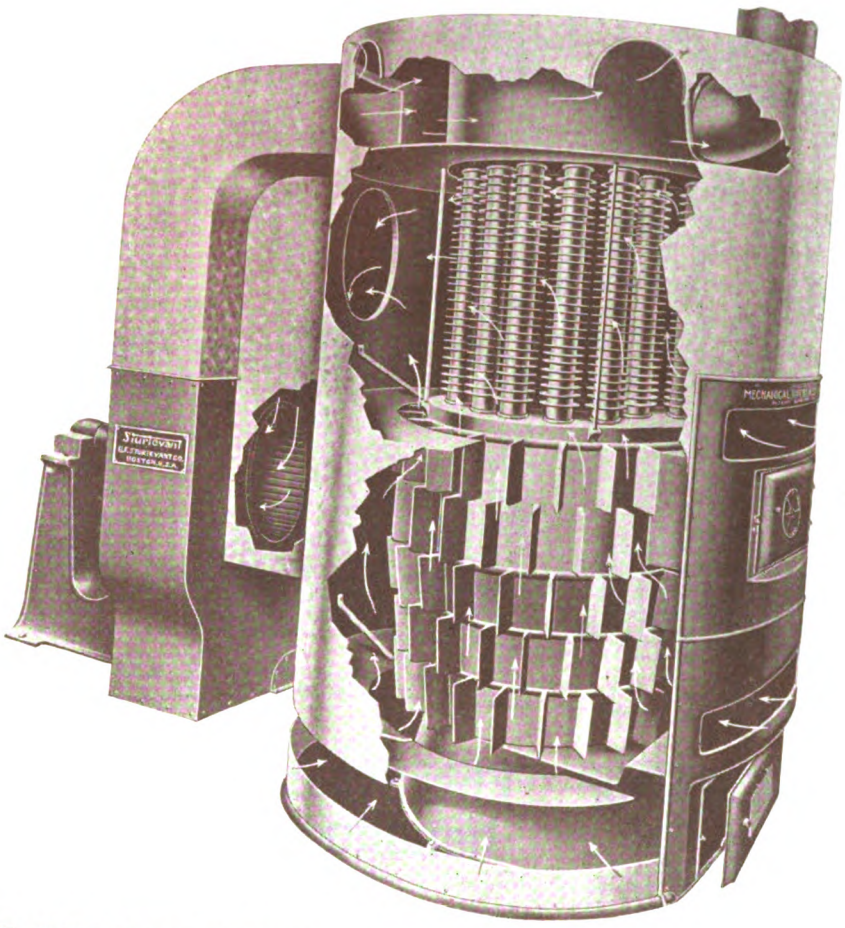
All the tunnels of the main aqueduct are so placed that they will be under a slight upward pressure from the contained water.

At Priest, a reservoir will receive the water brought by the aqueduct. It is expected that the incoming water will arrive at the constant rate of 400,000,000 gallons per day. This means 619 cubic feet per second. But the water will be utilized at varying rates, because the demands for power will naturally fluctuate from hour to hour. On the other hand, no extensive fluctuation in demand is apparently in contemplation, because the capacity of the reservoir as planned will be only the flow of two days. A small sheet of water will be created, whose cubic amount is estimated at 2,500 acre-feet—that is, the cubic content of a lake 1 foot deep covering an area of 2,500 acres. The power plant is to be built on Moccasin Creek near by. The dam impounding the water will be an earth and rock-fill structure with a height of 145 feet. A concrete core wall will be imbedded in the mass. There will be an outlet tunnel from this reservoir, which will conduct water through an adjoining ridge. This will have a length of perhaps one and one-third miles. At the end of this tunnel, the water will pass into steel pressure tubes which will convey the water to the power plant on Moccasin Creek. Each of the pressure pipe lines will be 4700 feet long.

The maximum hydrostatic head will be 1315 feet. This means the very considerable pressure of more than 1700 pounds per square inch at the base, neglecting frictional reductions. The power developed by the water-wheel and dynamo installations will naturally fluctuate with the demand. It is, however, estimated to amount to an average through the day of 70,000 horsepower. At the beginning there will be an installation of three generating units, each having a rating of 20,000 kva. These are to be driven by double-over-hung impulse water-wheels.

The forebay capacity for the Moccasin Creek hydroelectric plant is considered rather unusual. However, the other power plants of the system are so located that the topography of the adjacent country does not permit the construction of forebays. That is to say, these plants will operate steadily at 100 per cent. of their respective

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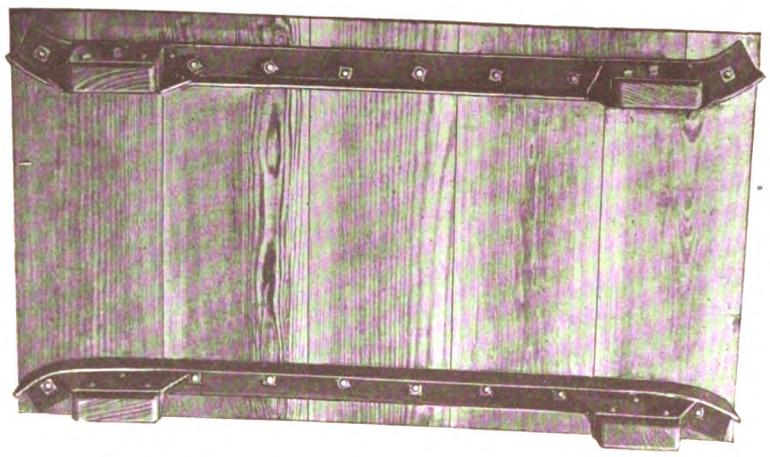
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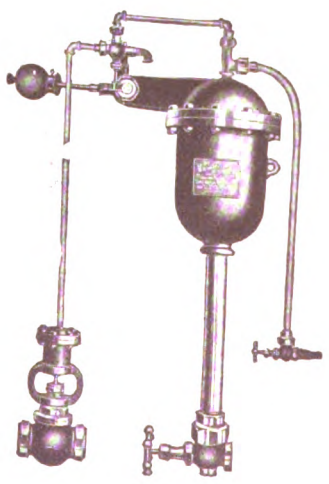
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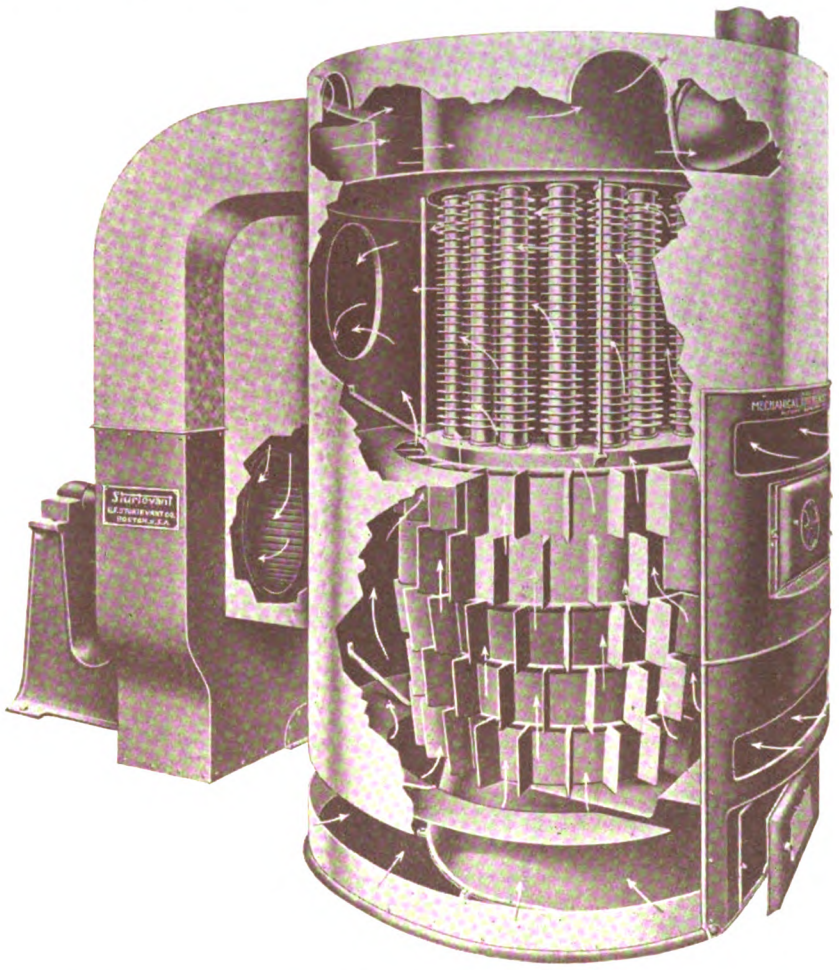
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capacities. Moccasin Creek will have to take care of the entire fluctuation in the demand for power. Eventually, it is expected to entail at Moccasin Creek additional generating units for the purpose of providing for the peak loads that are to be expected.

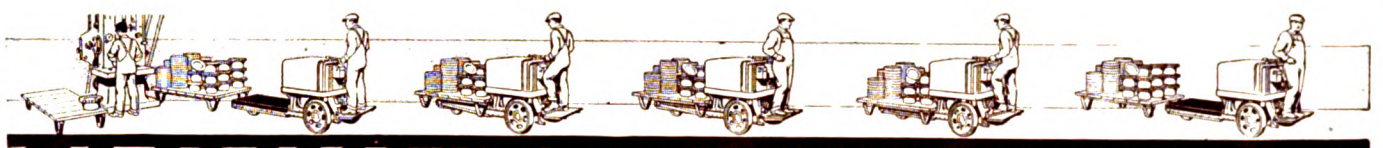
The water flowing through the Moccasin Creek Power Plant will naturally be water that is destined for water supply purposes at San Francisco and perhaps adjacent centers of population. But it will not be needed for this purpose at once. Enough water for the immediate future will be furnished from the Spring Valley water supply. When the time approaches to conduct Hetch-Hetchy water to San Francisco and vicinity, it will be necessary to construct the aqueduct west from Moccasin Creek. In the meantime the Hetch-Hetchy water will be serving mankind with power in the form of electric current. However, the water is good for power purposes and also for the ordinary uses to which water is put. That is to say, water from high elevations may be made to generate power as a by-product while it is flowing on to serve the cities in the lowlands.

When Hetch-Hetchy water is wanted for water supply purposes, the beginning point of the necessary aqueduct construction will be at the tail-race reservoir which receives spent water from the Moccasin Creek Power Plant at Elevation 900. This figure shows that the levels of the lower districts are being approached, although as a matter of fact the aqueduct route west of this point is really a large part of the total. The first part of this route will be occupied by a seventeen-mile tunnel to Oakdale Portal. This is a point in the foot-hills to the east of the San Joaquin Valley.

The foregoing tunnels with one exception are designed to carry 400,000,000 gallons of water per day. The exception is the tunnel leading from Priest Reservoir, which is to have still greater capacity, in order that excessive loss of head may be avoided when the Moccasin Creek Power Plant served by it has to take care of peak loads.

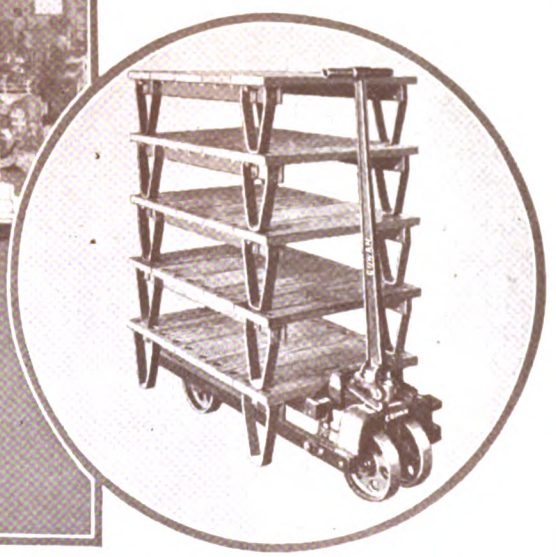
A long aqueduct is apt to pass through quite a variety of topography. It may in consequence be necessary to vary the type of construction used for the aqueduct in order to satisfy proper requirements in an economical manner. Thus, in the construction of the Catskill Aqueduct for the City of New York, the type of conduit varied from section to section. At one place the aqueduct would consist of a covered trough, no upward pressure of water calling for consideration. At another point, a pressure tunnel through the solid rock would form the aqueduct. And so on. At the crossings of valleys, it was frequently decided to use steel pipe lines. These constitute the standard means of carrying the aqueduct across valleys on the east side of the Hudson, south of the great crossing of the river from Storm King Mountain to Breakneck Mountain. A considerable advantage of the use of such inverted steel siphons consists in the readiness with which an initial installation of less than the ultimate may lat-

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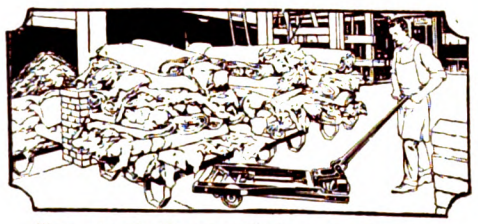
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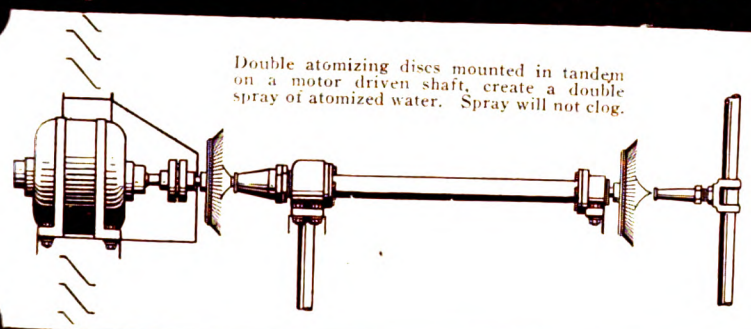


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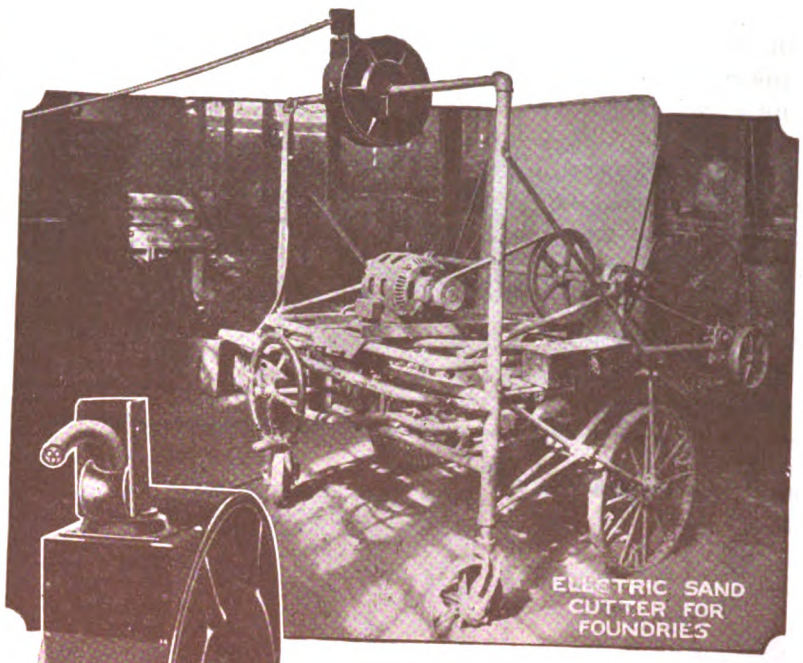
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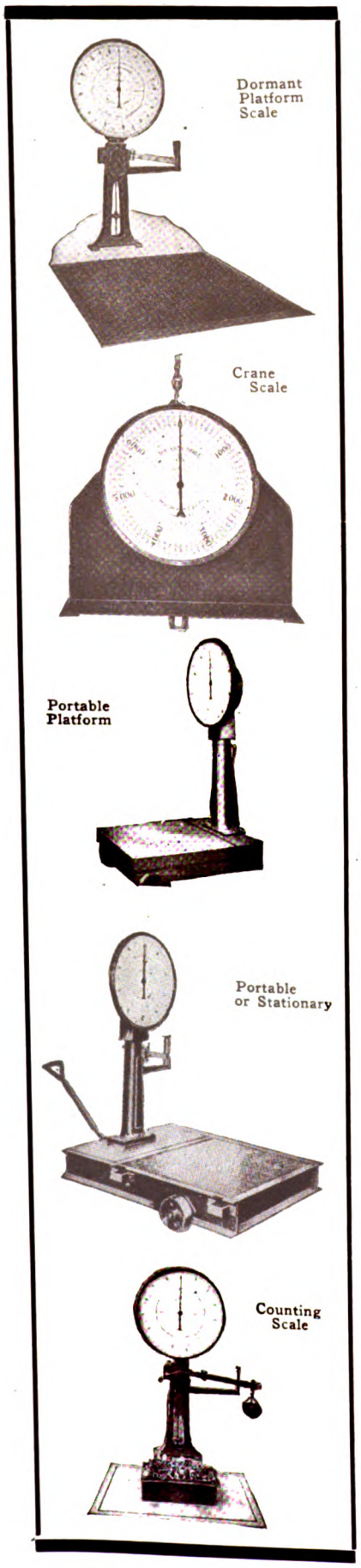
er on be converted into the complete installation of full, ultimate capacity. The valley crossings of the Catskill Aqueduct that I have referred to were designed to carry the ultimate amount of water in a triple system of tubes. At the beginning, however, only one tube was installed.

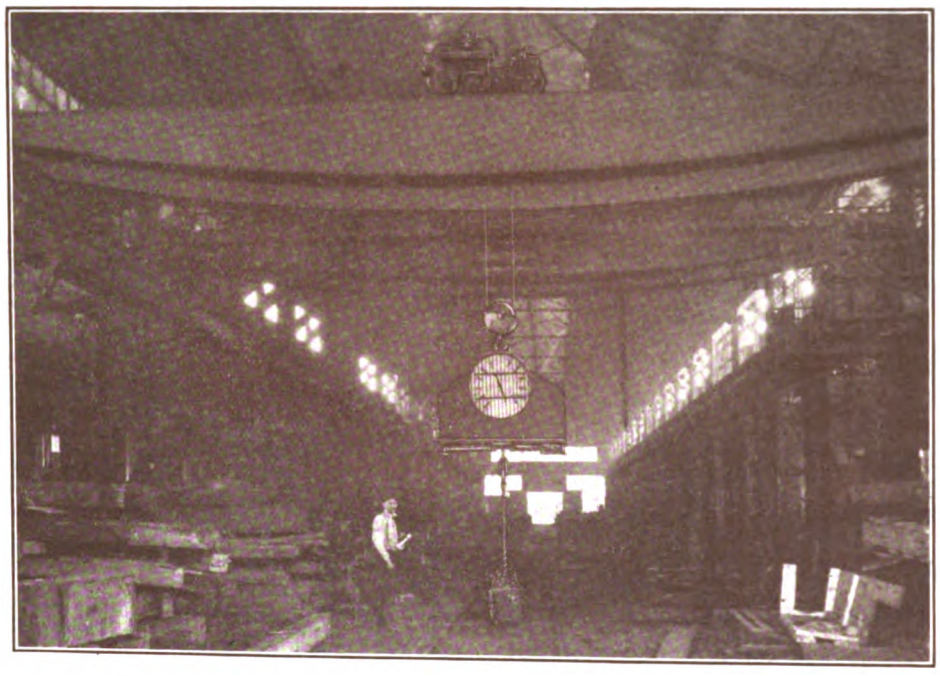
Now, at the San Joaquin Valley, the San Francisco Aqueduct will have a forty-five mile crossing from Oakdale Portal on the east to Tesla Portal on the west. It is expected that eventually three pipe lines will be installed, each with one-third of the total capacity of 400,000,000 gallons per day. It will be quite possible to put in at first a single pipe line, leaving the installation of the others to await the demands of the San Francisco Metropolitan district. It is calculated that for seven-tenths of the forty-five miles, these pipe lines will be under a pressure due to a head of from 450 to 540 feet—that is, to a pressure round 195 to 234 pounds per square inch.

West of the San Joaquin Valley, the Coast Range must be penetrated by the aqueduct. This will be a long tunnel 31 miles in length. At the west end, at Irvington Gate House, the aqueduct will be within about three miles of the waters of San Francisco Bay, although far to the south of San Francisco itself. Doubtless, it was desired to avoid a crossing of the Bay at points where the full width would be encountered.

The aqueduct is to be divided at Irvington Gate House into three terminal sections. The principal section will continue westward, crossing a narrow portion of the Bay, and will swing north to San Francisco. The ultimate capacity of this portion is to be one-half of the total—200,000,000 gallons per day. Another section will serve the East Bay cities, and the third will extend south and supply San Jose. The San Francisco branch will, at the crossing of Alameda Creek, receive water from the Spring Valley System, which water will naturally mingle with that from Hetch-Hetchy.

A good deal of pipe-line construction will be involved in completing the work after the penetration of the Coast Range. The advantages of this mode of construction that have already been pointed out will probably be kept prominently in mind, as everywhere economy is a great compelling cause. In connection with the aqueduct, as has already been intimated to some extent, it is proposed to utilize the Spring Valley Water System as far as possible, both in the avoidance of the duplication of construction and in the utilization of near-by water resources. But after all economies are taken into consideration, the ultimate cost of the Hetch-Hetchy project will be enormous. It is highly fortunate then that the enterprise is of such a character that a big hydroelectric development may be constructed in the early stages of the undertaking and made to produce a steady and increasing revenue. After the example afforded upon so large a scale, there will doubtless be many imitators.





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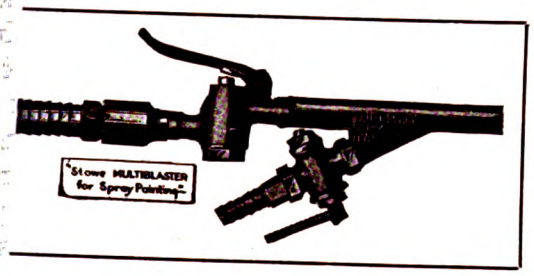
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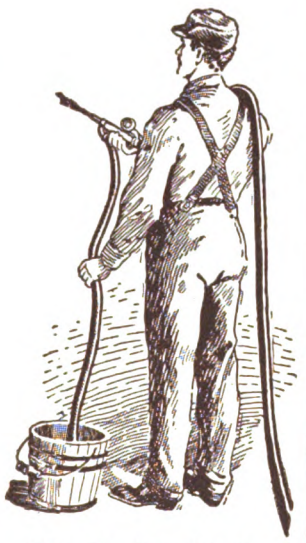
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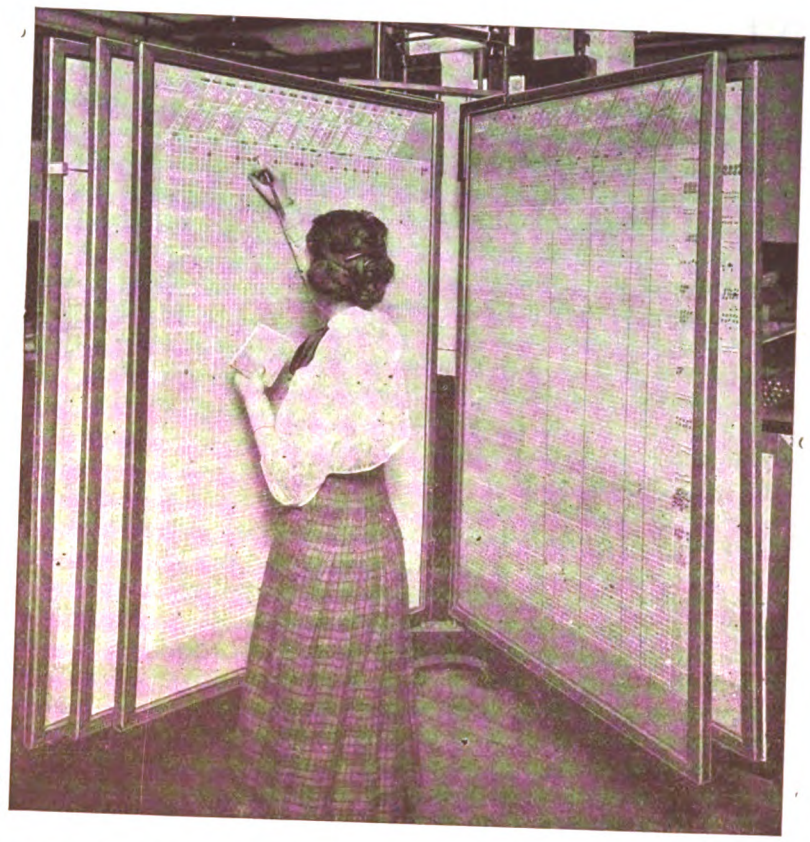


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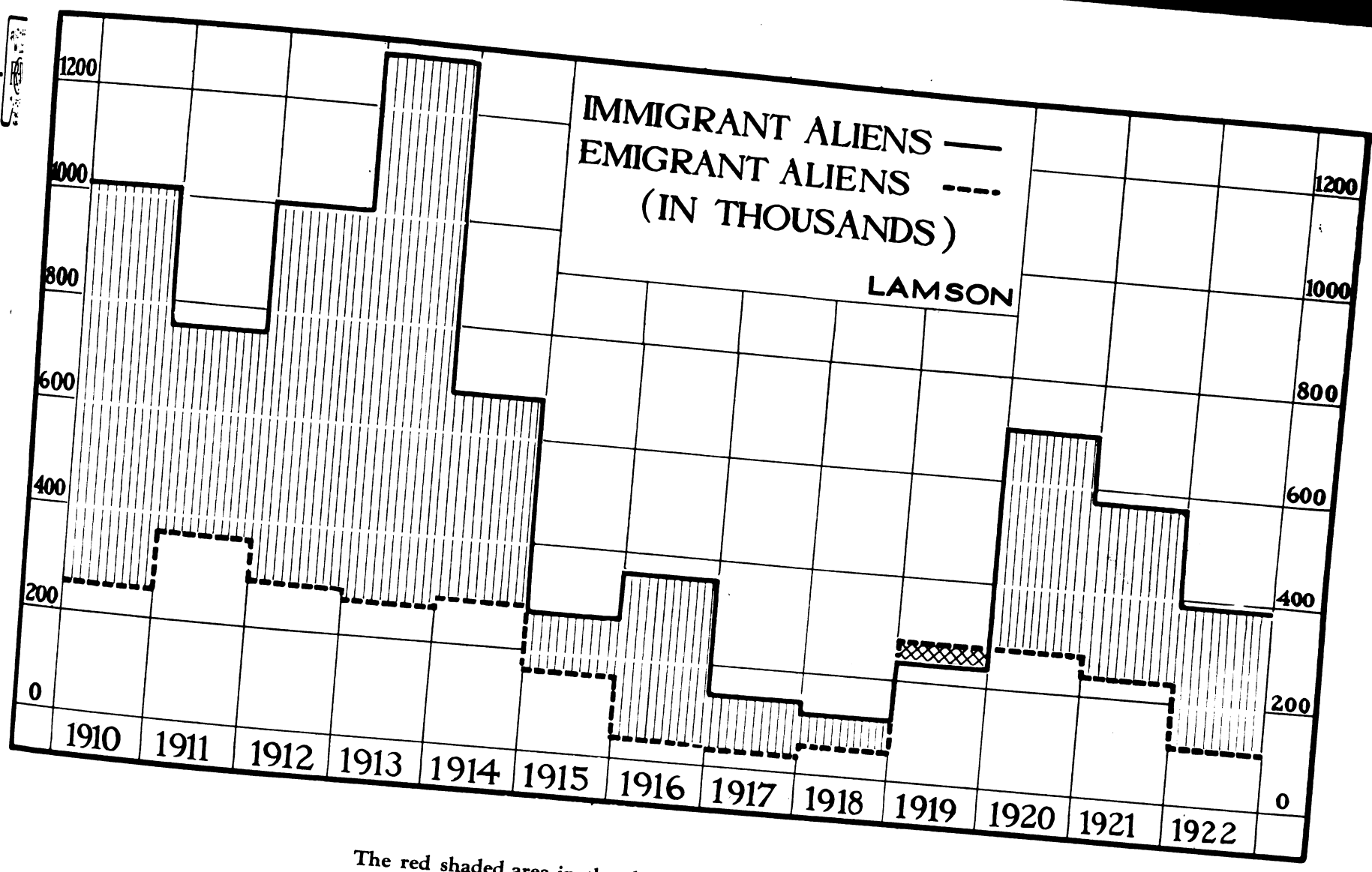
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The red shaded area in the chart shows the yearly balance of incoming over outgoing laborers. The black shaded area in 1919 indicates a deficit. Year taken from Jan. 1 to Dec 31 inclusive.

Relieving the common labor shortage

COMMON labor is scarce and is becoming scarcer. Men are hard to get, and harder to hold. Wages for common labor in some industries have doubled within a year.

And the present shortage is here to stay. The chart shows how the war checked immigration, and how the present restrictive policy is cutting down the balance of incoming over outgoing laborers.

But turning to the figures for common labor, we find a situation that is truly alarming. During the eight months ending Feb. 28, 1923, the *net* immigration of common labor was only 21,536, while for the year ending June 30, 1922, *there was an actual exodus of common labor over and above those who came in, of 63,332.*

Immigration restrictions may be lessened, but they will never again be wholly relaxed. There is one remedy, and one only—*doing by man power which, overhead considered, can be done by machinery.*

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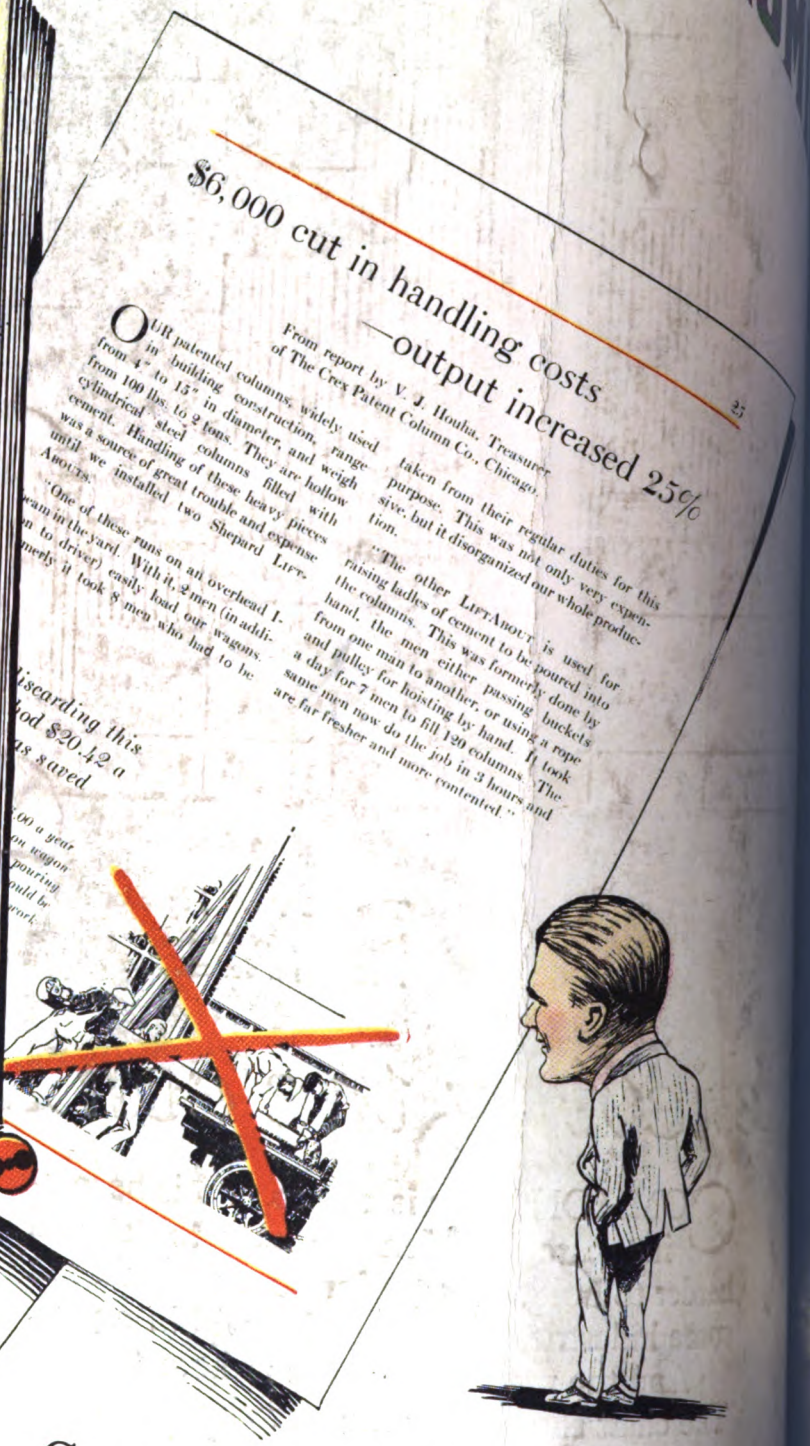
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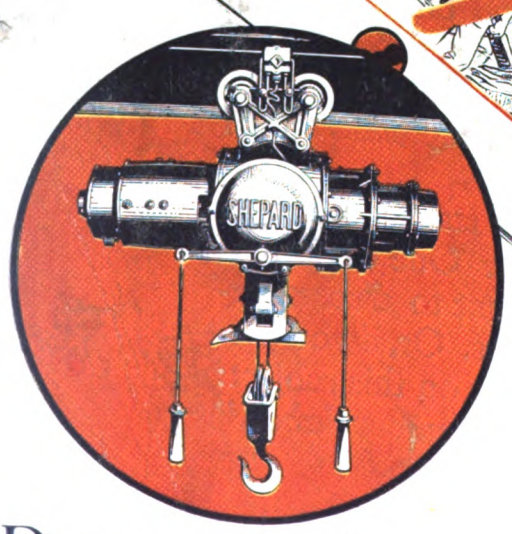
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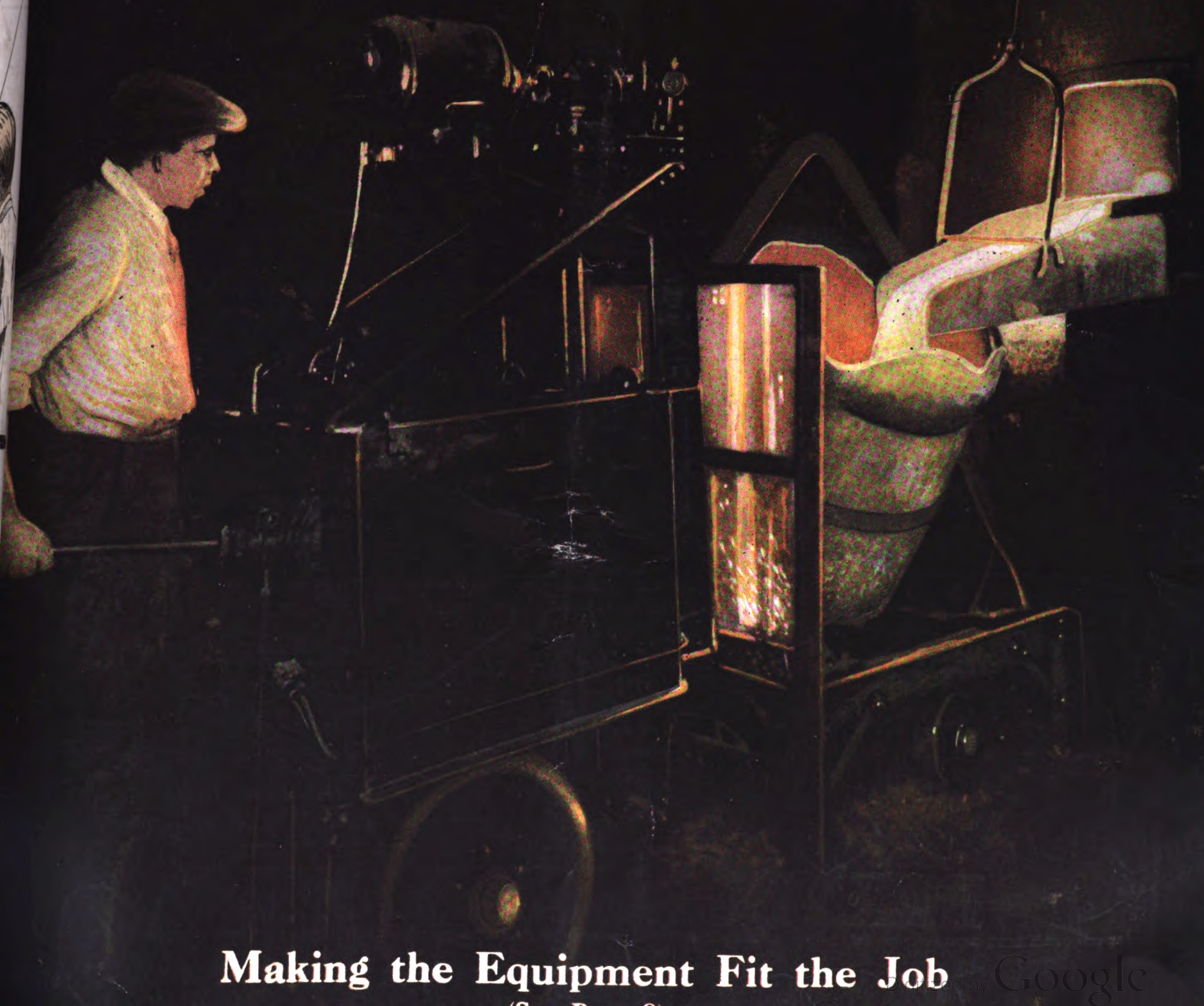
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TOBER 1923

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Industry Illustrated

Men, Methods and Machinery of Modern Management



Making the Equipment Fit the Job

(See Page 8)

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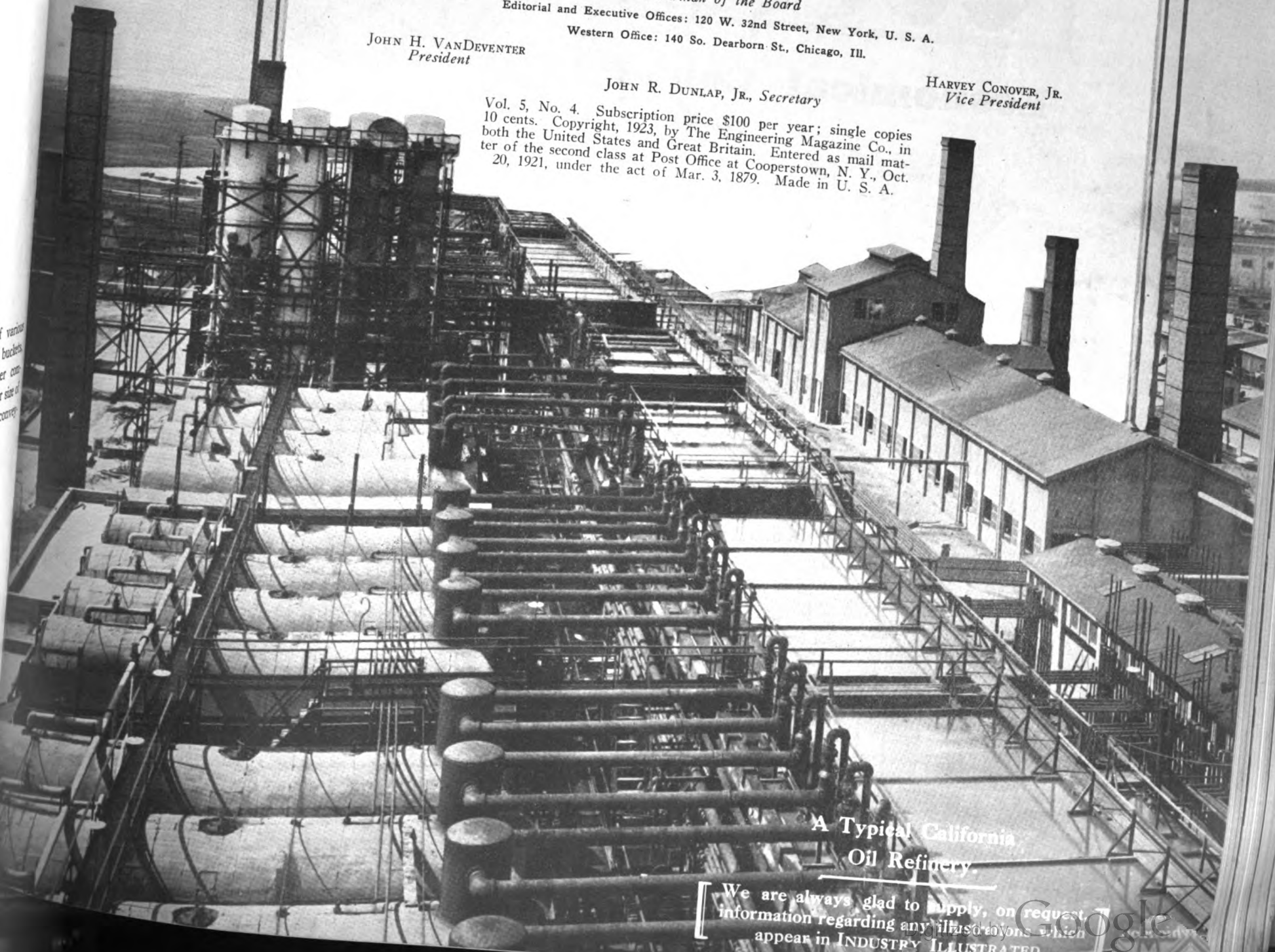
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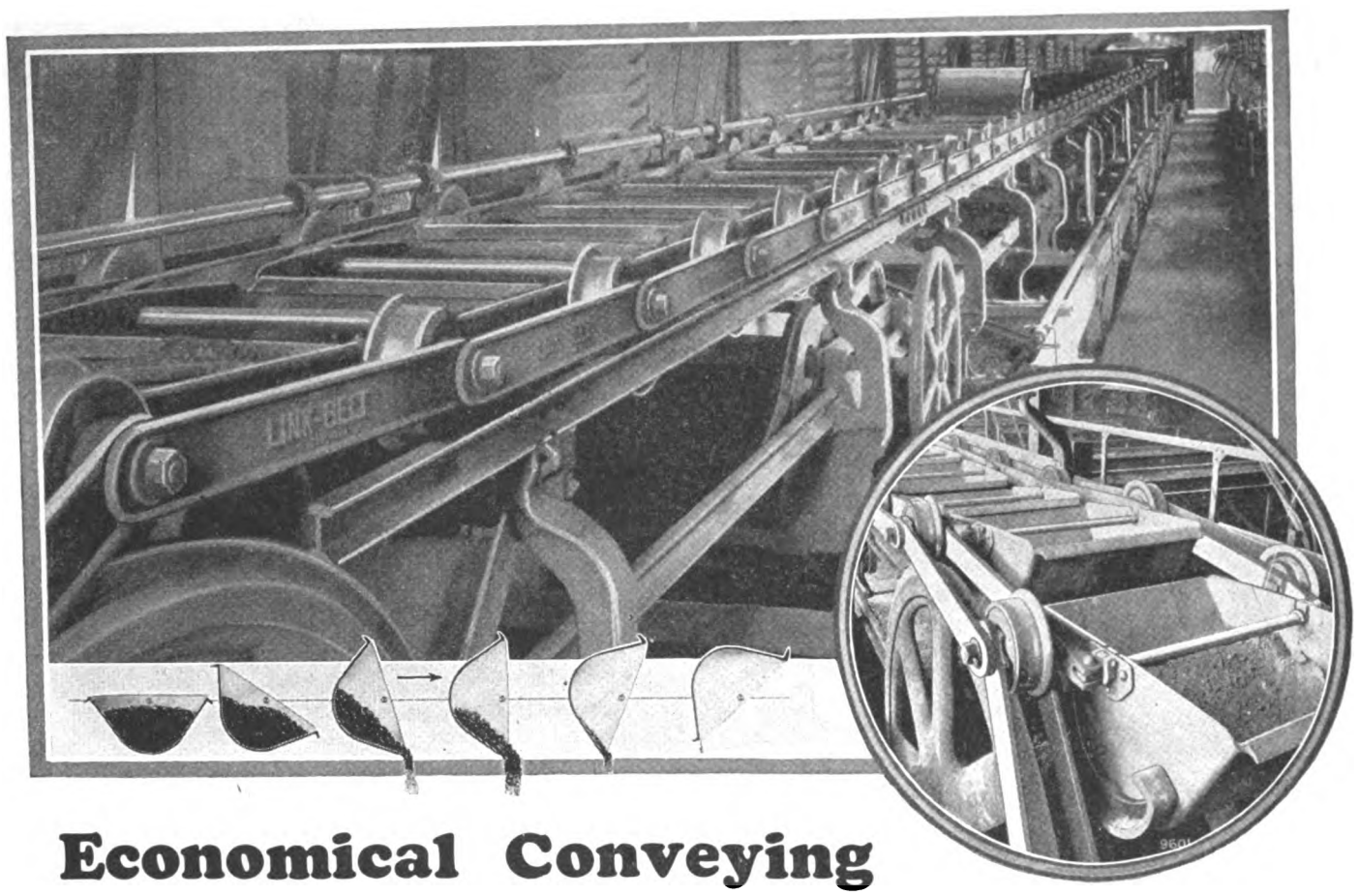
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A Typical California Oil Refinery

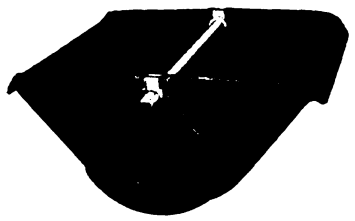
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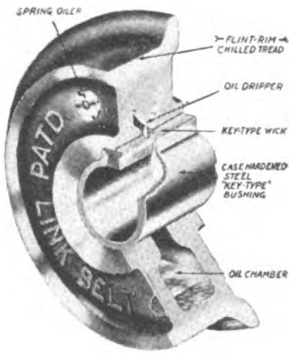
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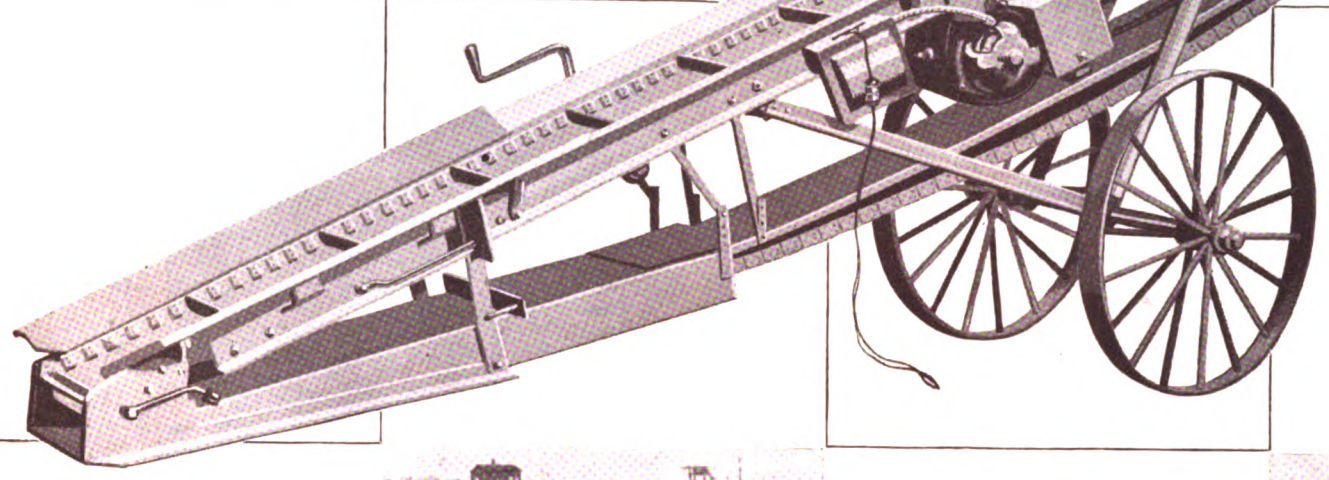
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1—*REPLACING WHEELBARROWS. A Type U Loading brick from a kiln for the Onondaga Brick and Tile Co. at Onondaga, New York. It shortens wheelbarrow hauls in this case. In others, it does away entirely with wheelbarrow work.*

2—*UNLOADING CARS. A Barber-Greene Type U being used for "hauling out" coal by the Martin Lumber Company, Geneva, Illinois.*





U-Type-Barber-Greene Portable Conveyor, equipped with electric motor.

3—*LOADING FROM PILES. In this case, the material handled is oyster shell, and four Type U Barber-Greenes carry it from stock piles to barges. New Haven, Conn.*



4—*PIT WORK. A Type U handling gravel for Pierce and Piron, of Aurora, Ill.*



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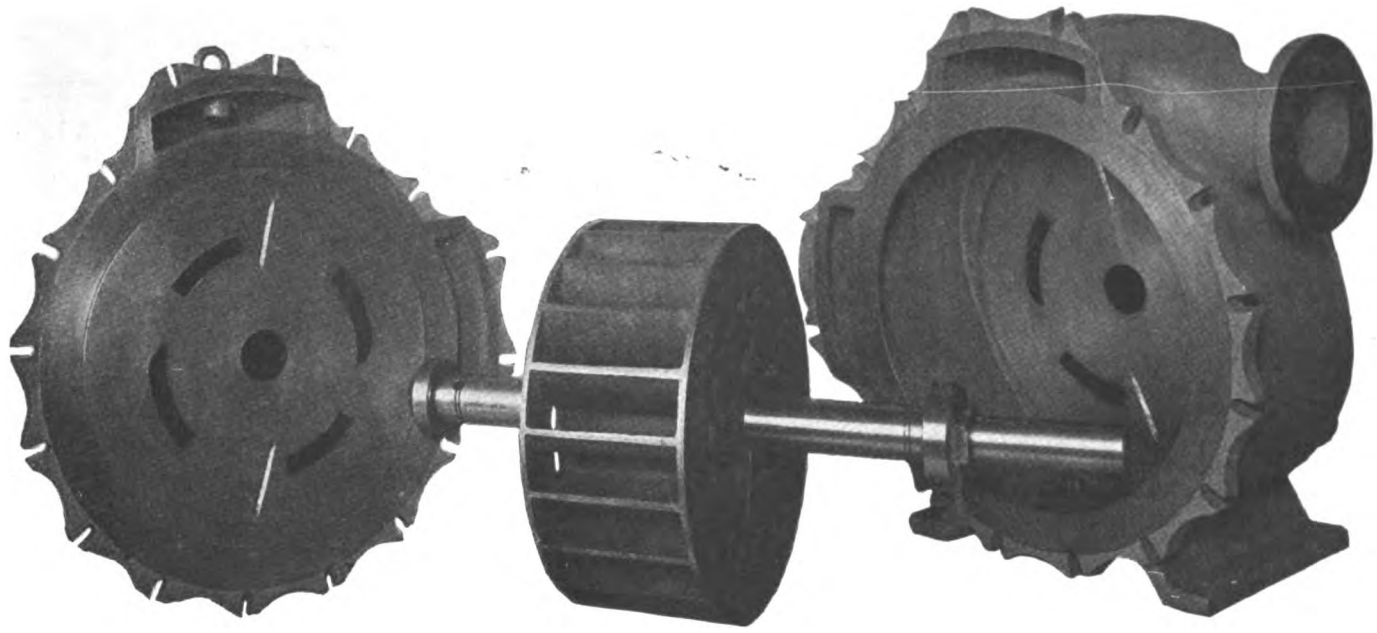
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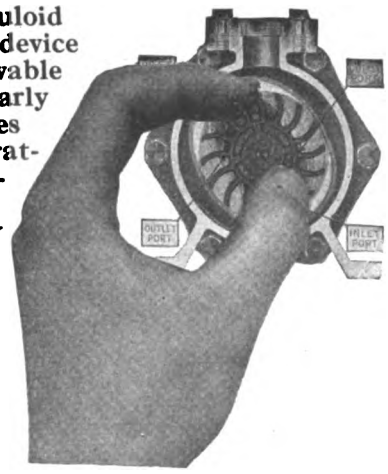
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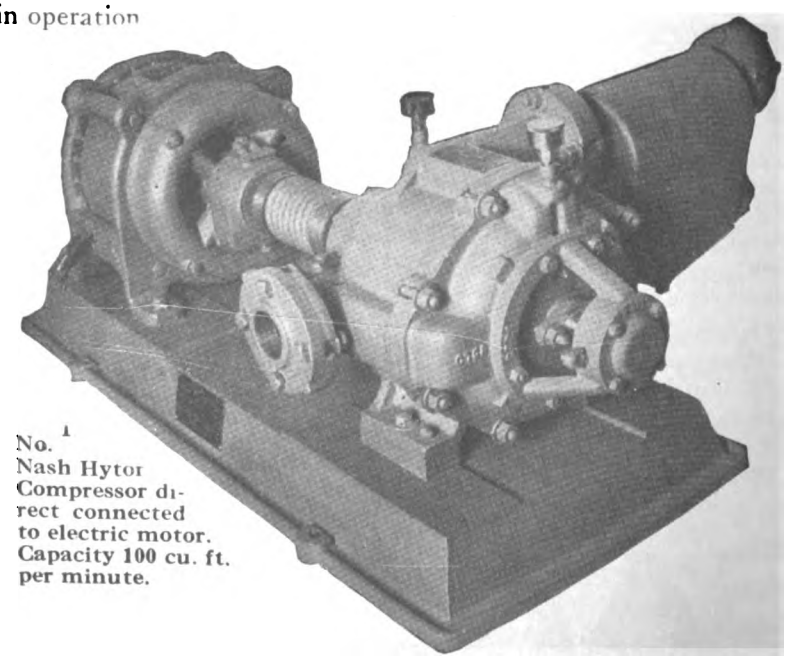
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EDITORIAL

What of the Next Two Years?

THE recently announced terms of settlement of the coal strike accomplish one thing: they give promise of a two-year period of uninterrupted production. All three of the parties interested in the dispute both win and lose. The miners win a wage increase but lose the check-off; the operators lose on the wage issue, but win on the check-off principle; the public wins as to continued availability of fuel, but—as usual—is to pay the costs in higher fuel prices.

So far as the agreement assures continued production, it is a success. But as a permanent settlement of the coal question, it is merely a postponement. Right on the heels of the agreement, we read the report of the Coal Fact Finding Commission—whose recommendations and analysis bear out the foregoing statement.

The march of evolution is exceedingly slow and often cumbersome, but it is relentlessly sure. All those things which we enjoy today, are the result of industrial evolution. And the progress of this evolution is determined always by our ability to reduce the net cost of production of these necessities and conveniences, thereby making them available to a greater number; in short, raising the average standard of living, and reducing the average of man's necessary labor.

It is from this standpoint that conditions in our coal industry are intolerable. Until recently, there was no known substitute for coal, and therefore conditions in that industry became somewhat analogous to conditions in an absolute monarchy. Even today, we probably could not do without coal entirely; but we have oil, and we have water power—both being developed as active competitors.

There was a time when a certain king of France gave voice to a famous phrase: "The State?—*I* am the State." And only yesterday, the attitude of the coal producers—"Power?—*Coal* is Power"—was justified. But the day of monopoly is following the day of absolute monarchs into the discard.

We are living in an age of industrial civilization—an age of competition. More than anything else, it is an age where cheap mechanical power is the one essential thing.

It lies within the power of those in the coal industry, to put the next two years to good use; to set about a house-cleaning which shall once for all put our greatest basic industry upon a common-sense basis. If they will take the initiative, and attack the problem fearlessly and without favor, it will be the greatest piece of constructive work accomplished in many years—and the present breathing spell will have been justified.

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Making the Equipment Fit the Job

Special Trucks That Eliminate the Back-Breaking Jobs

BY MATTHEW W. POTTS

A RECENT article appeared in this magazine, under the heading "Solving the Impossible," and called the readers' attention to the possibility of making many ingenious material handling devices from standard parts, and illustrated some of these conveyors and elevators which were now successfully performing mechanical operations that had always been considered as necessary evils to be performed by hand labor.

It is not difficult to obtain standard equipment for the majority of materials handling operations, but there are certain operations which standard equipment cannot be adapted to, and it is often impossible to change the method of operation. The manufacturers of materials handling equipment, and various engineers, however, have solved so many difficult problems that they now consider nothing impossible.

Some of the equipment which has been designed to meet particular transportation problems would come under the heading of special trucks, and are particularly known as tiering trucks, crane trucks, dump body trucks, furnace charging trucks, ram trucks, paper trucks, and special load-carrying trucks. These trucks were all primarily designed to meet some special need, and today several of them are almost considered as standard equipment, although further development is continually keeping them in the field of special equipment.



Fig. 1. The gasoline drive dump body truck shown does as much work as the 8 men with wheelbarrows in the handling of coal from storage pile to boiler house.

The only truck in the above classification that has been developed to such a point that is now considered standard, is the tiering truck. This type can be purchased in either gasolene or electric drive, and with various special attachments. Because of the fact that there are several manufacturers of these special trucks, there are on the market today, several different designs of tiering trucks, but all are using the same principle, namely; a cantilever platform travelling in a pair of uprights. The main difference is in the hoisting mechanism, and the location of the elevating motor drive and control.

Four different makes of tiering trucks are shown in figures 9, 10, 15 and 17. Special adaptations of the tiering principle are shown in figures 8 and 16, the latter not considered as standard equipment.

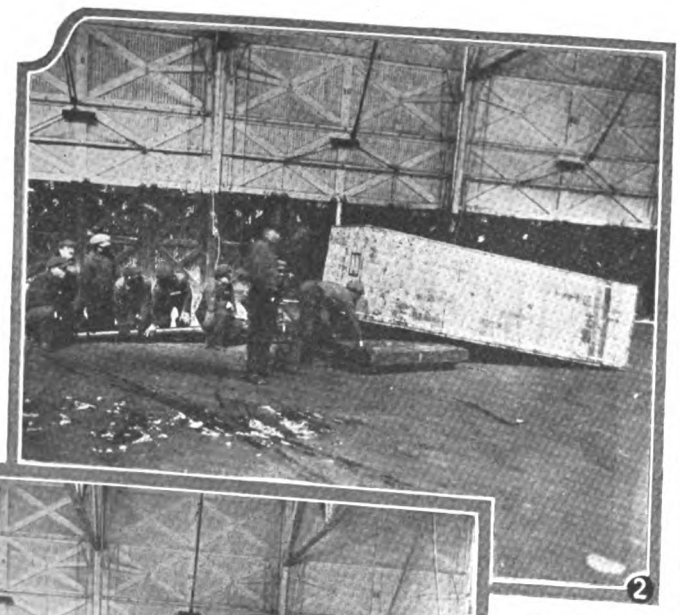


Fig. 2. When necessary to move automobiles packed for export, it required 9 pier laborers as shown to load them on to the hand truck.

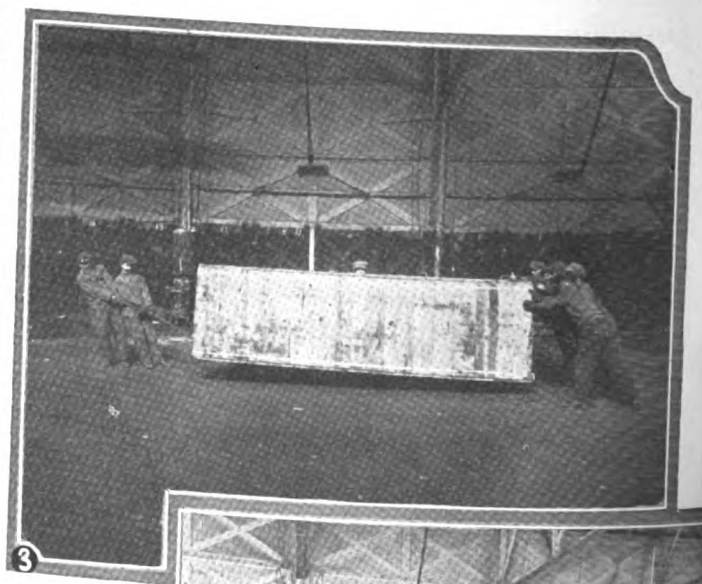


Fig. 3. This is a slow and expensive job. It requires 8 men to move the load after it is placed on the hand truck.

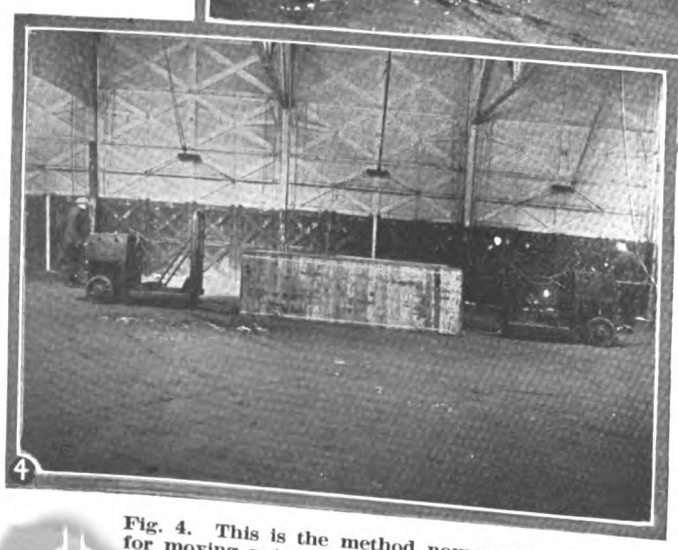


Fig. 4. This is the method now employed for moving automobiles on the piers. Note how the two electric storage battery finger trucks pick up the load.

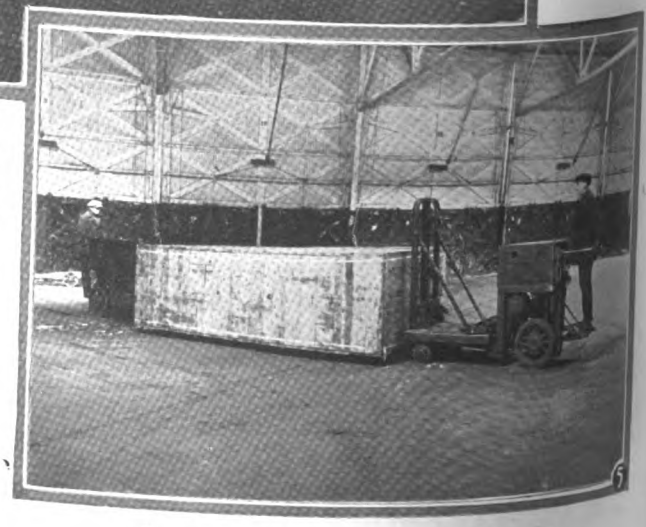


Fig. 5. The electric trucks raise the load and carry it suspended between them. This method of operation is much cheaper and quicker.

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Fig. 6. Piling material is expensive when hand labor is used. By using a tiering truck and placing one loaded skid on top of the other as shown, the work can be done more quickly and cheaply. This installation saved $100 per week.



Fig. 7. Handling high grade refrigerators so as not to mar them is a problem. This type of lift truck moves them quickly and reduces rejects because of damage caused in handling.



Fig. 8. The tiering truck principle has many applications. Chemical plants find this platform attachment very advantageous. The arms are arranged to handle cyclindrical or square packages.

but as special equipment to handle particular problems. These illustrations show how the same type of truck is treated in mechanical design by various manufacturers. Each manufacturer has also a trade name for the tiering truck which he produces. The same thing is true of all special design trucks, but there is no need of the executive becoming confused in making comparisons between different manufacturers, if he will look closely at the principle of operation, as well as the truck design and truck name.

Tiering trucks were primarily designed for the piling of materials, but after they were put into service, it was found that they could be used on a number of operations, such as loading motor trucks, (figure 14), freight cars, placing dies in punch presses, raising materials to machines (figure 10), work benches, etc. Today they are recognized as combining the advantages of high and low lift trucks and they have so many possible intra-plant applications that a simple arrangement of the movement of materials will keep them constantly busy. They can be used to lift loaded skids from the floor, transfer them to a given place, and raise them to such a height that the cost of stacking or tiering in storeroom, freight car, steamship hold, etc., is reduced to a minimum.



Fig. 9. These trucks not only transport the load, but greatly assist in piling it in warehouses, on piers, etc.

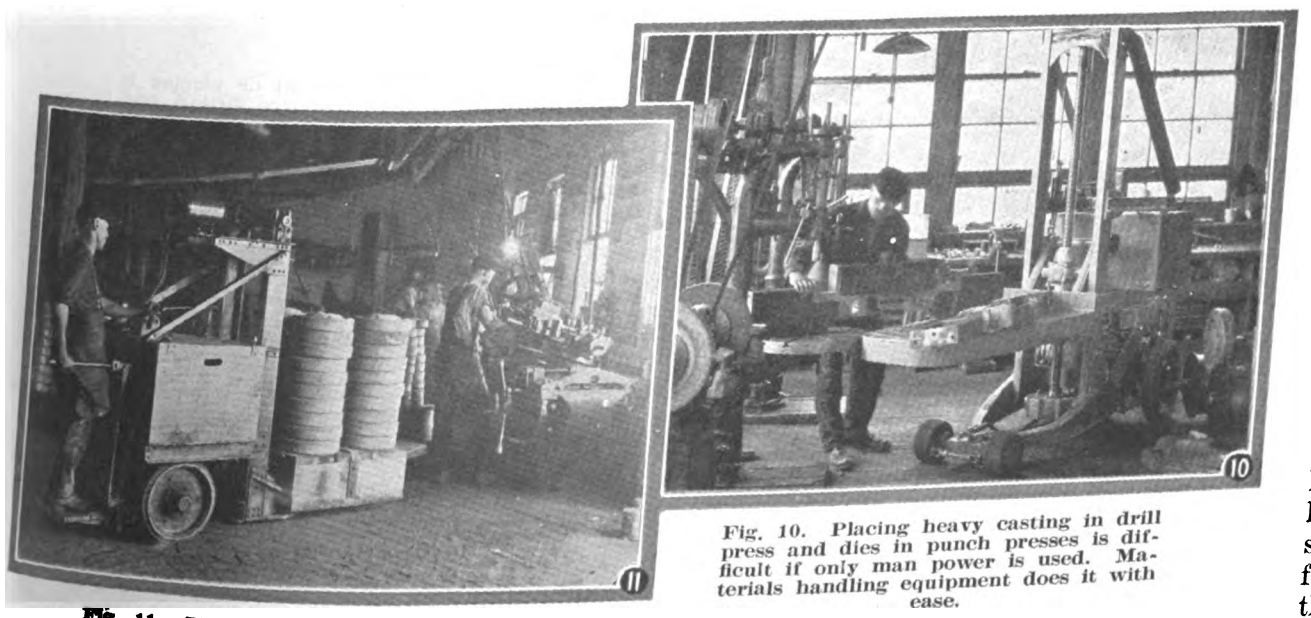


Fig. 10. Placing heavy casting in drill press and dies in punch presses is difficult if only man power is used. Materials handling equipment does it with ease.

Fig. 11. The special truck can frequently be used on more than one operation. Here is a tiering truck handling skid loads of materials between machine operations at the Medina Mfg. Co.

With old hand operations, a large food distributor used to place a skid load of material on the floor, and then have the lift truck bring a second skid load, and in order to conserve space, two men took the goods from the second skid, and piled them on top of the first skid load, thus necessitating the breaking down of the piles

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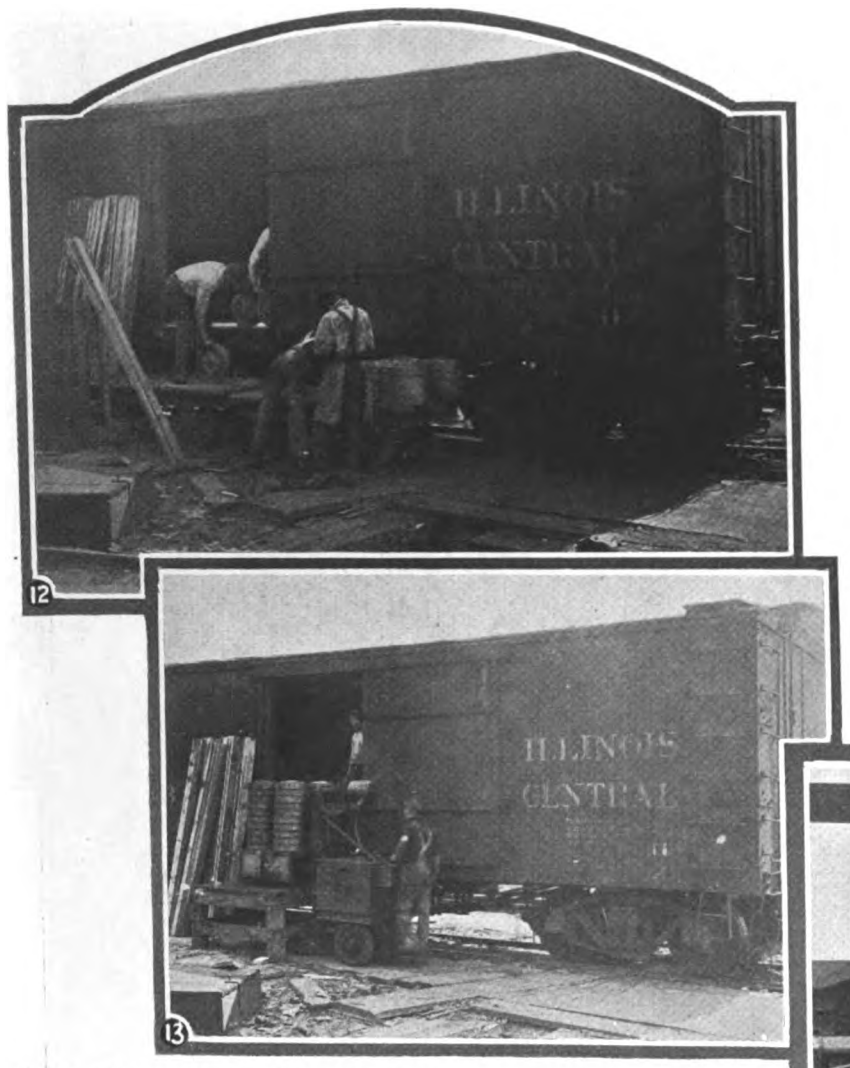


Fig. 12. This is the method of car loading at the Medina Mfg. Co. before the tiering truck was purchased. Note the placing of the hand trucks and the three men outside the car.

Fig. 13. The tiering truck at the Medina Mfg. Co. not only transports the materials between operations, but carries and raises the finished products to the car door level, thus saving $20 per car loaded.

when the material had to be taken from surplus to active storage. Today the method is as shown in figure 6, where a tiering truck is used entirely in the handling of these goods. The skids are loaded at the car, and the first skid load is placed directly on the floor. Then two wide boards are placed across the load, and the second skid load is placed with the legs resting on these boards. This eliminates the two men which were formerly required for piling, and also eliminates the two men that were used nearly all the time breaking down the piles and taking the goods from surplus to active stores.

Piling materials with hand labor was expensive, but by using the tiering truck, and by placing one loaded skid on top of the other, as shown, the work is done more quickly and cheaply, and the installation of the truck saved $100 per week.

It is not necessary to keep these trucks on one particular operation, and it will be found after they have been installed that they can handle materials in a number of places about the plant. An atual saving of $100 per week, 50% increase in storage capacity, and a reduction in the number of men required for handling and loading automobile fly-wheels, is the record obtained by the Medina Manufacturing Company,

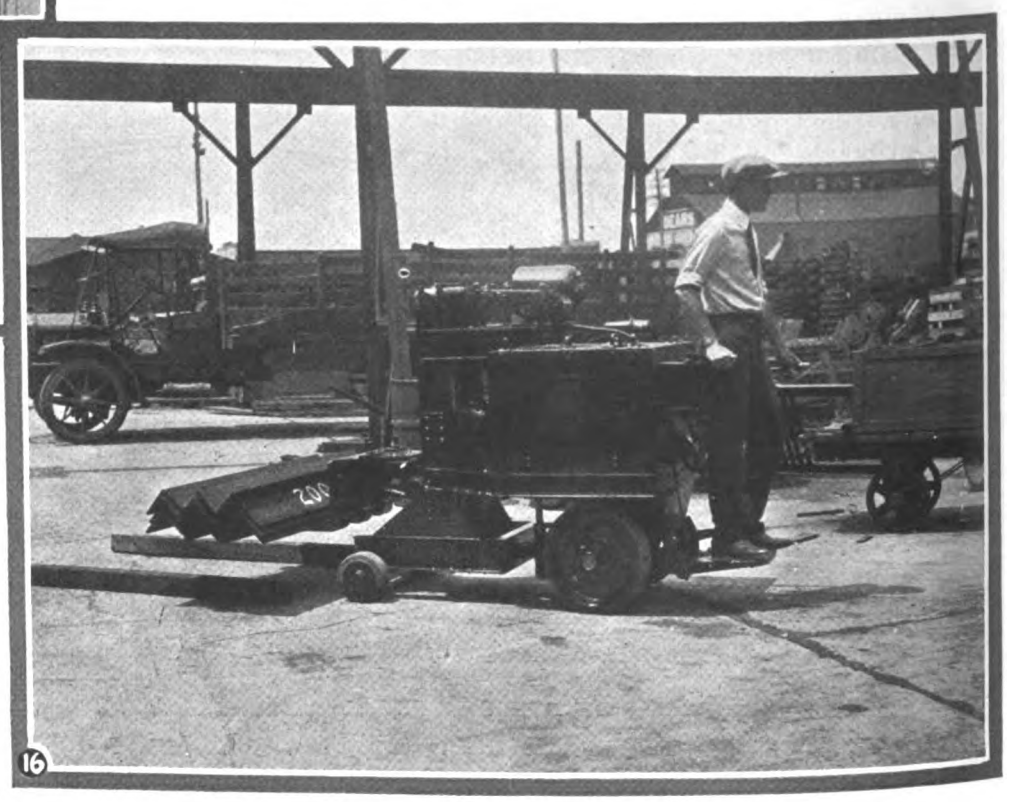


Fig. 16. Fingers on material handling equipment are becoming quite common. This truck picks up the load the same as a man's hand, except that the load can be heavier.

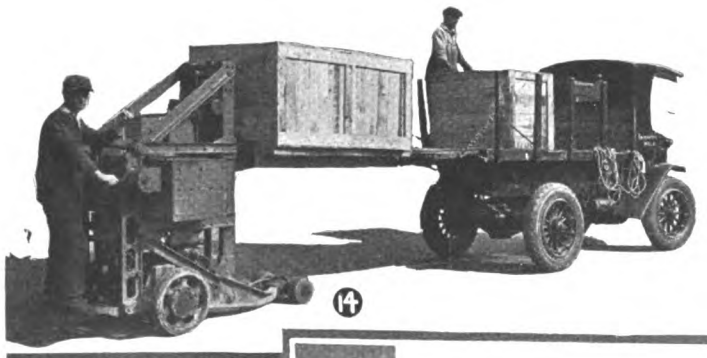
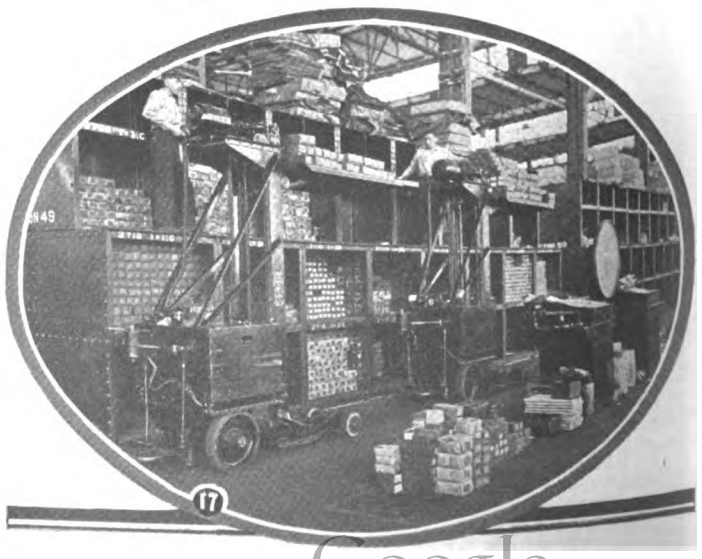


Fig. 14. Transporting and raising loads is the function of the tiering truck. Where truck loading platforms are not available this method of truck loading saves time and money.



Fig. 15. While all the other tiering trucks shown are electrically driven this illustration shows one that is completely operated by a gasoline drive.

Fig. 17. Piling material or placing it in bins, usually requires lifting and climbing. These trucks raise the load to any point up to eight feet from the floor.



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Medina, Ohio, after they had installed a tiering truck. Before the installation of the truck, no particular method of handling was used. Fly-wheels were handled and re-handled through the various processes of machining, storing and loading. Machine operators spent a large portion of their time in bringing work to their machines, aisle-ways were blocked, carloading required a force of from five to nine men. The average time required to load a car was five hours, and the work was done as shown in figure 12 (note the placing of the hand trucks and the three men outside the car).

Under the new methods, as illustrated, figures 11-13, the flywheels are kept on skids. As the castings are brought from a neighboring foundry, they are unloaded directly on to these skids. Each skid carries 40 fly-wheels, weighing 100 pounds each. The loaded skids are picked up by the tiering truck, transported from machine to machine through all of the various operations, and are finally set down in the storage department. The orderly progress of the fly-wheels through the various machining processes saves much time for the machine operators. This saving is estimated at $10 per day.

An average of two carloads of finished fly-wheels are

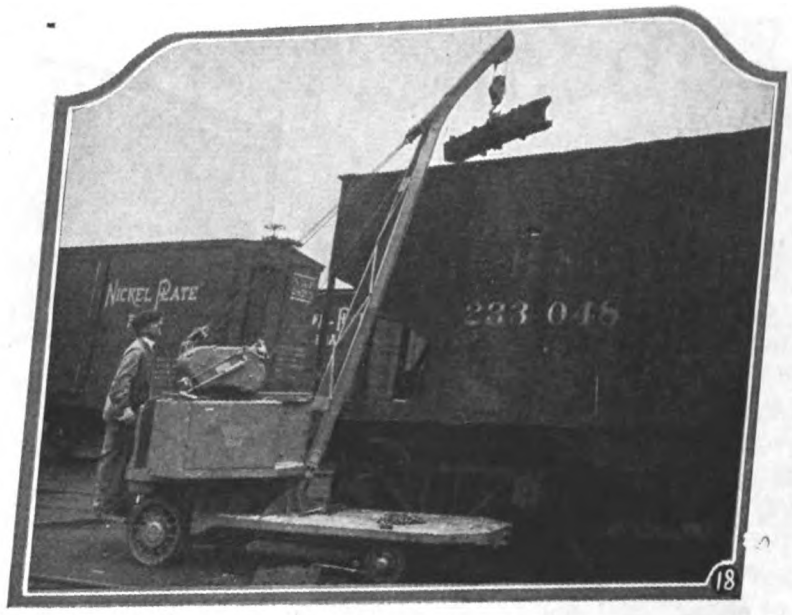


Fig. 18. While the tiering truck is a great lifter the crane truck is also quite adaptable to this class of operations. This long boom can be used in many places about the yard and plant.

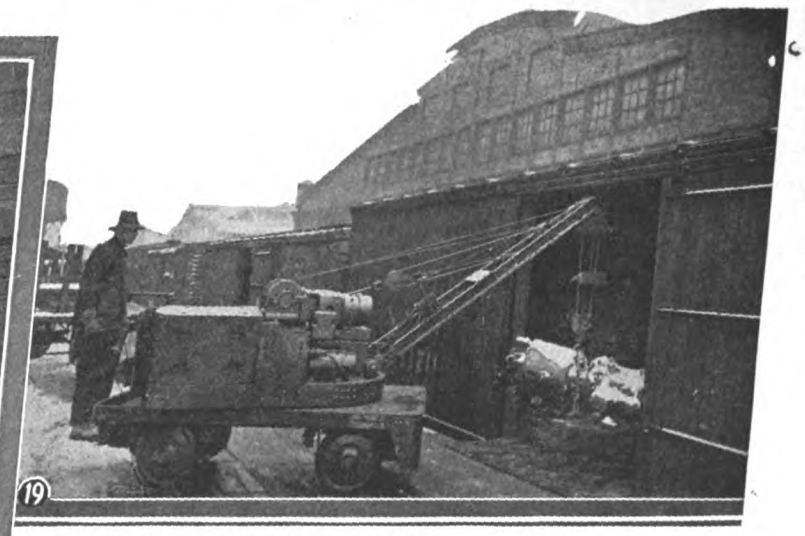


Fig. 19. This crane truck carries only the load on the hook, but is sturdy and quite applicable to many operations.

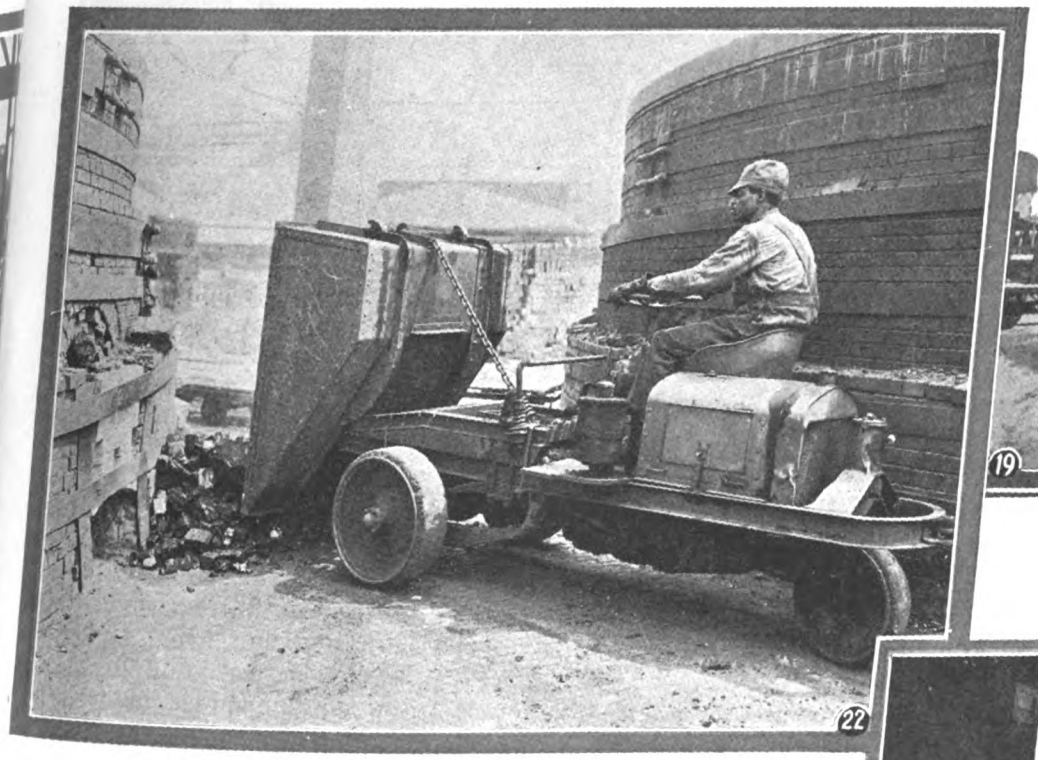


Fig. 22. This is the same truck shown in illustration 21 and shows the method of dumping near the kilns. The Globe Brick Co., East Liverpool, Ohio, saved $526.90 per month on coal handling by using two of these trucks.

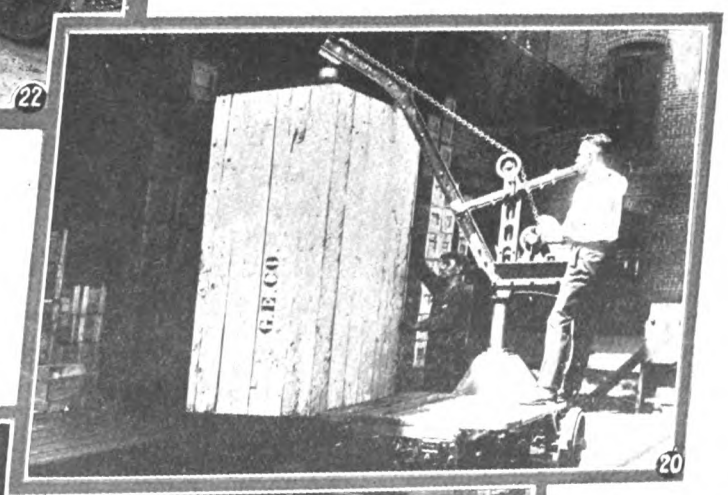


Fig. 20. This truck carries the load on the truck platform and the crane is only used for loading and unloading. This shows a good example of the work that can be performed.

Fig. 23. Standard electric truck fitted with a special carrying frame for handling rolls of paper and other loads of similar size and weight.

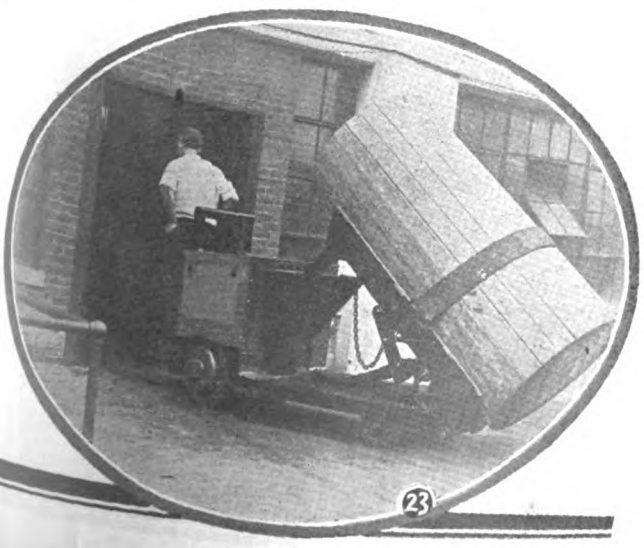




Fig. 21. Dump body trucks are great money savers. This gasoline drive truck is receiving the load direct from the track hopper. Note the location of the gate handle in relation to the driver.

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Fig. 24. The flexible band holding the load in position makes it possible to grip all unwieldy packages so they can be transported by mechanical instead of man-power.



Fig. 25. Many trucks have been designed for handling rolls of paper. This view shows how rolls of paper are picked up on this type of truck.

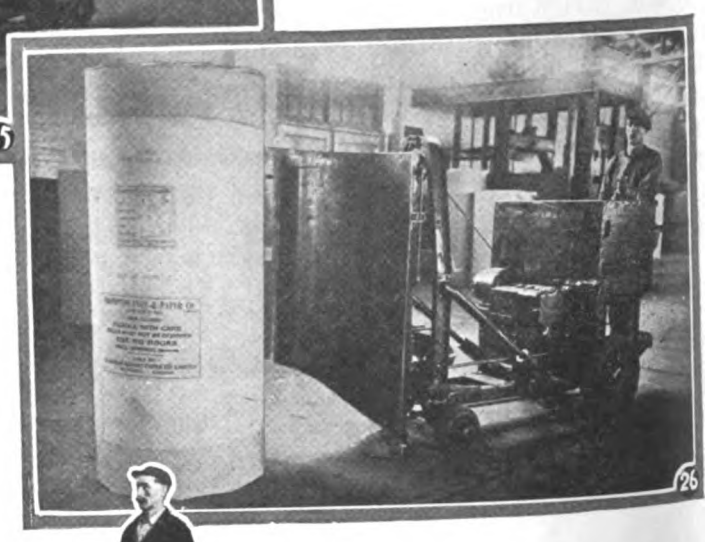


Fig. 26. Same truck shown in fig. 25, but showing the position of the roll when it is unloaded. The load is transported in an inclined position.

shipped per week. As previously stated, formerly from 5 to 9 men were required to truck the wheels and to load the cars. Since the tiering truck is available for this operation, one operator and two men do the work, loading a car in one and one-half hours, at an estimated saving of $20. The method employed in loading the box cars is found to be the most efficient, in using the time of the men and the truck. In piling the fly wheels in the car, they are rolled through the car door back into place. Further, the time saved by setting the skid load of wheels into the car door would not be sufficient to warrant the construction of a runway under the car and across the rails, so that the front wheels of the truck would have a place to rest on while placing the skid load directly in the car. The truck is therefore run parallel to the freight car and places the skid on a movable platform as shown in the illustration, figure 13. The floor of the skid, when placed in position, is level with the car floor.

This particular installation illustrates that a systematized handling plan, even employing special trucks, is applicable to the smaller shops, as well as to the larger concerns, which have more intricate processes and many departments. The saving in money, time and space is perhaps of even great-

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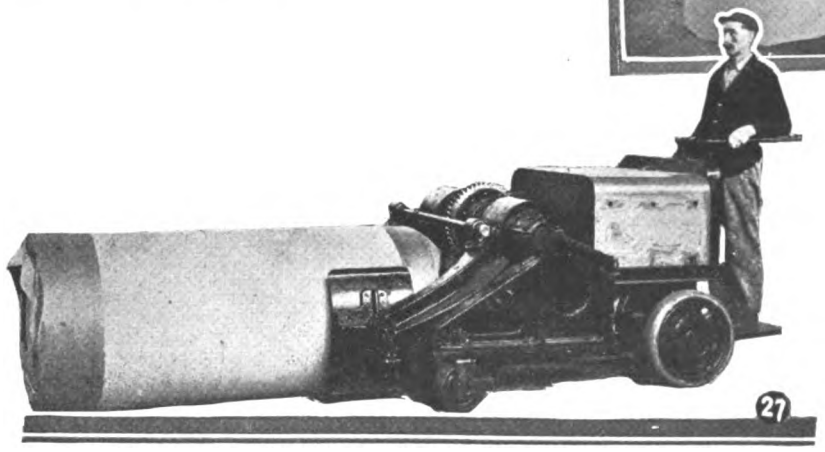


Fig. 27. A different type of paper truck performing the same operation. Note the resemblance to a man's hands in the grips. Fig. 28 shows the roll upended.

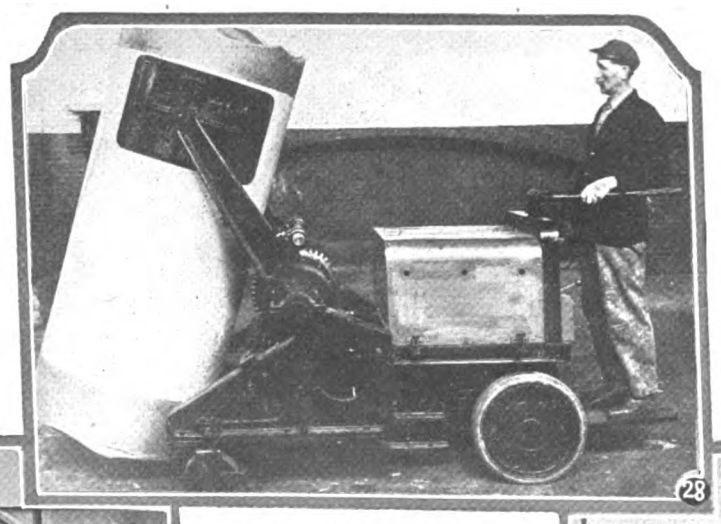


Fig. 28. The use of this truck in one paper plant effected the savings of $21,000 per year in wages alone on the basis of 300 working days.

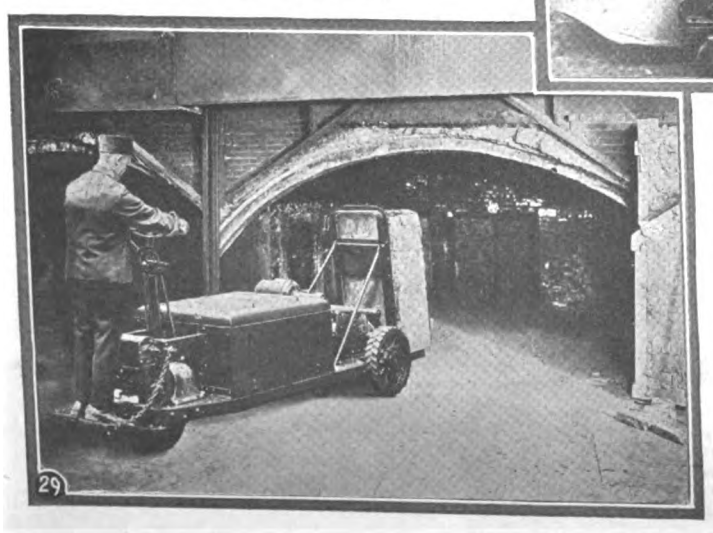


Fig. 29. The charging of furnaces in a number of industries is a difficult problem. This electric truck does the work at a very low cost.



Fig. 30. Charging trucks can also be used for handling materials about the yard and plant, when they are not busy charging the furnaces.

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October, 1923

Training the Inexperienced Worker

BY JAMES WADE RUSSELL, M. E.



Fig. 1. The Central Training Section, where the larger part of the newly employed personnel is received for training.



Fig. 2. One of the Segregated Sections for specialized training: a fenced-off section of one of the plant departments.



Fig. 3. At the right, men are glazing butcher knives; an example of the training on actual production work.

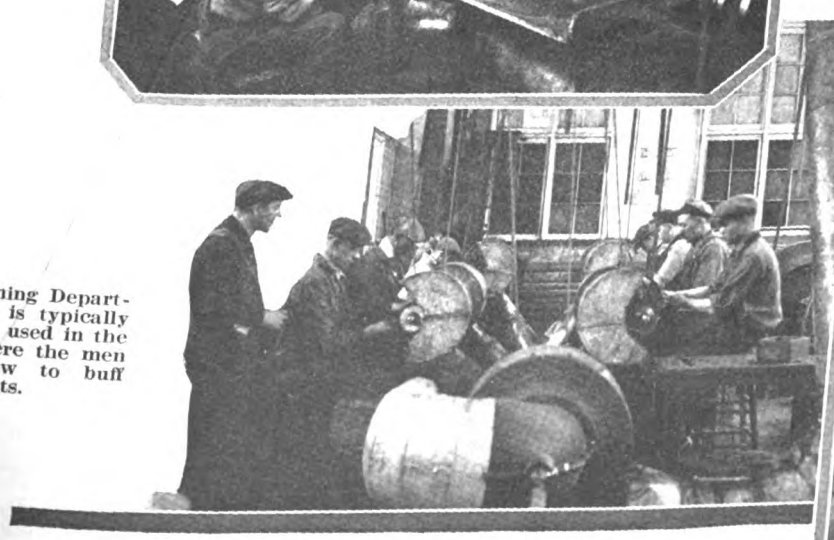


Fig. 4. The Training Department equipment is typically the same as that used in the plant proper. Here the men are learning how to buff flashlights.

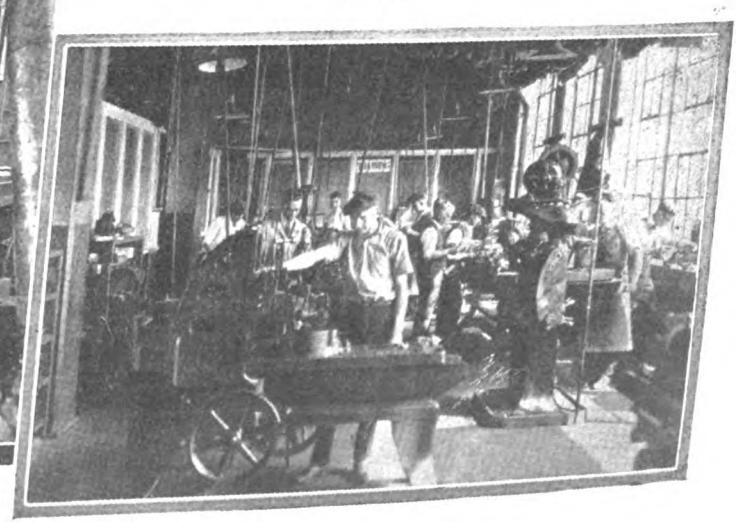


Fig. 5. Below—Up-grading machinists and tool-makers. Training is not only for novices, but also offers a path for advancement to experienced workers.

THE term Vestibule School was adopted by America from England. A great many people believe that the name was "born of the war" and adopted by American industries at that time, but as a matter of fact the term was used previous to the war both in England and Germany where the need of industrial training was recognized years ago. In fact, the Germans were the pioneers in industrial training activities long before the war, and studies were made by Americans who visited Germany, Switzerland and Belgium and the ideas were brought to America some fifteen years ago.

The development of Vocational Training had been very rapid in America previous to the war, but only in the form of intensive trade training in city, state and corporation trade schools where the prejudice of the old Manual Training Plan had to be broken down before the trade idea was enabled to take root and grow —this took about ten years, but only after it was clearly shown that a boy or girl could master a three year trade in two years, made possible through training by the "intentional" method rather than the old

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Why the Superheater?

The Principles of Steam Superheating and the Economies It Brings About

BY JAMES T. BEARD, 2ND

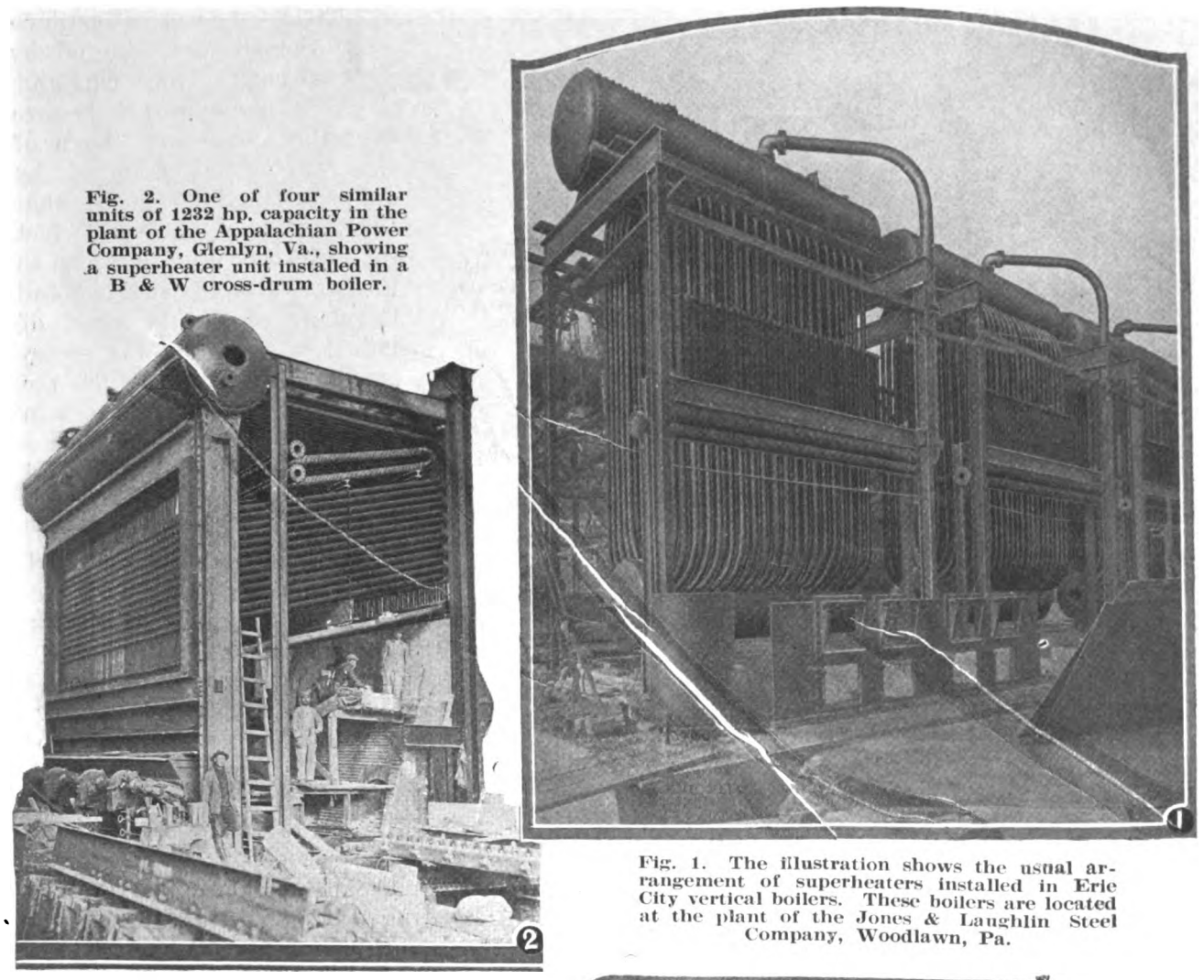


Fig. 2. One of four similar units of 1232 hp. capacity in the plant of the Appalachian Power Company, Glenlyn, Va., showing a superheater unit installed in a B & W cross-drum boiler.

Fig. 1. The illustration shows the usual arrangement of superheaters installed in Erie City vertical boilers. These boilers are located at the plant of the Jones & Laughlin Steel Company, Woodlawn, Pa.

THE approach of another winter finds the industrial world again face to face with their power problems and, more particularly, with the fuel problem and its effect upon the ultimate cost of the finished product and the profits of the enterprise. It is but natural that, during a coal crisis, deliveries are more or less unreliable and the quality of the coal when delivered is still more uncertain.

But whether there is a crisis or not the present high cost for fuel of any kind has made the power department of every industrial plant one of the most important factors in its daily operation and has directed the attention of the management to that department, with a view to eliminating unnecessary waste by effecting economies and cutting costs in every possible way.

These efforts toward efficient operation have necessitated intelligent supervision of a very high order, combined with improved methods of operating the plant and handling the equipment. In addition it has often been advisable to make alterations in the design and equipment, either by replacing old equipment with more modern and economical types, or



Fig. 3. In this installation a superheater is shown in a Springfield boiler. The superheater is supported by U-bolt strap around the drum and by hanger beams and rods from overhead structural steel members.

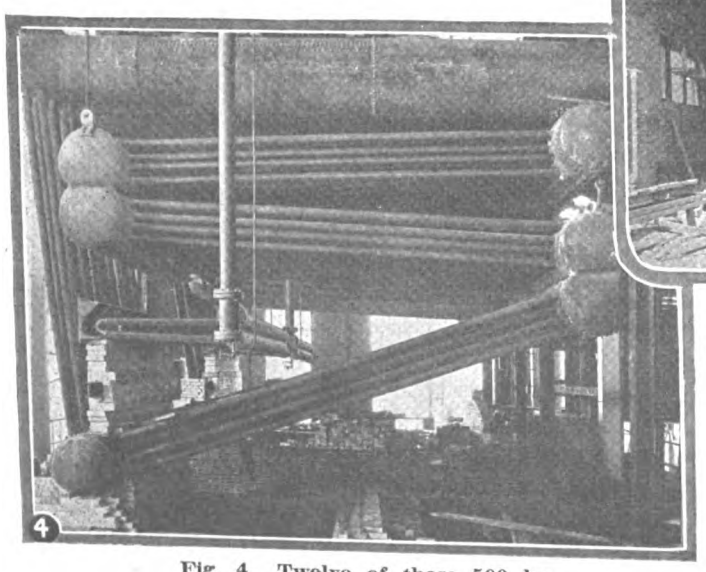


Fig. 4. Twelve of these 500 hp. Vogt boilers in the plant of the Standard Oil Company, Sugar Creek, Mo. are equipped with superheater units. The superheater headers are suspended from the boiler drums by means of air-cooled U-bolts.

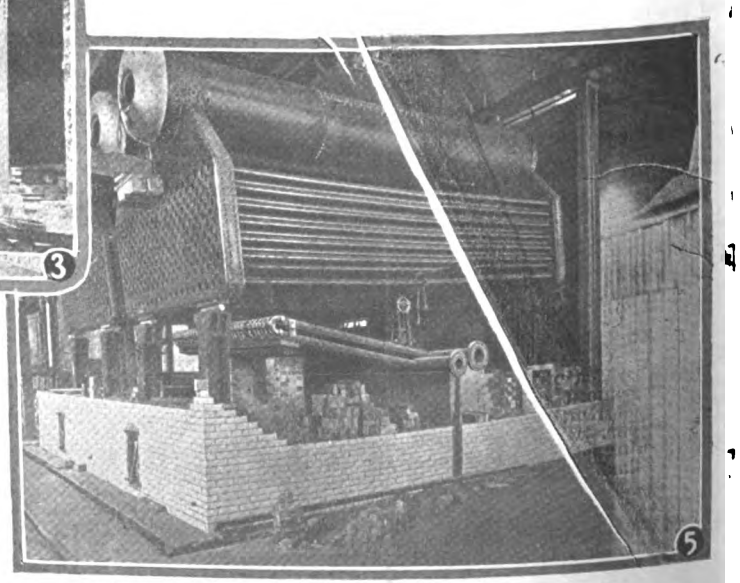


Fig. 5. Superheaters installed in O'Brien boilers in the plant of the St. Louis Water Works. The superheater units are located below the tube bank and behind the bridge wall. Headers are supported on pedestals from the floor. This arrangement is also used on Heine, Erie City, Franklin and other types of horizontally baffled boilers.

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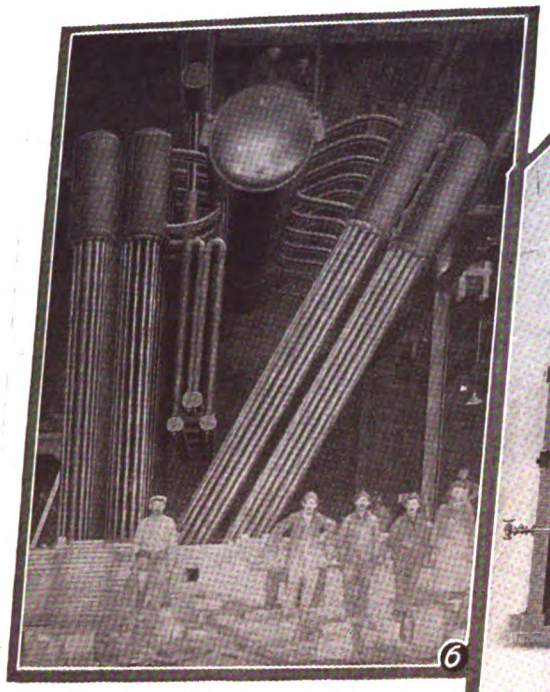


Fig. 6. Four of these 1375 hp. Bigelow Hornsby boilers in the plant of the Niagara, Lockport and Ontario Power Company, are equipped with superheaters, of the double deck type to give a high superheat.

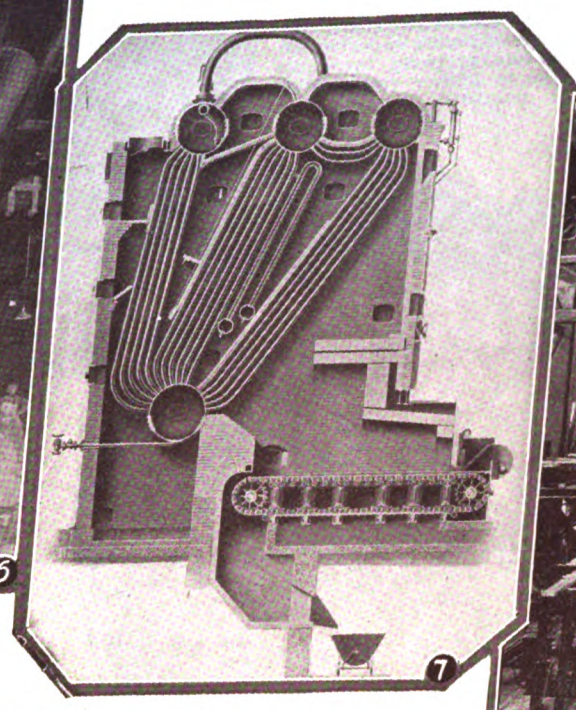


Fig. 7. Sectional View of a Stirling boiler installation equipped with a superheater unit. The hot gases come in contact with the superheater tubes after giving up some of their heat to the first bank of boiler tubes.

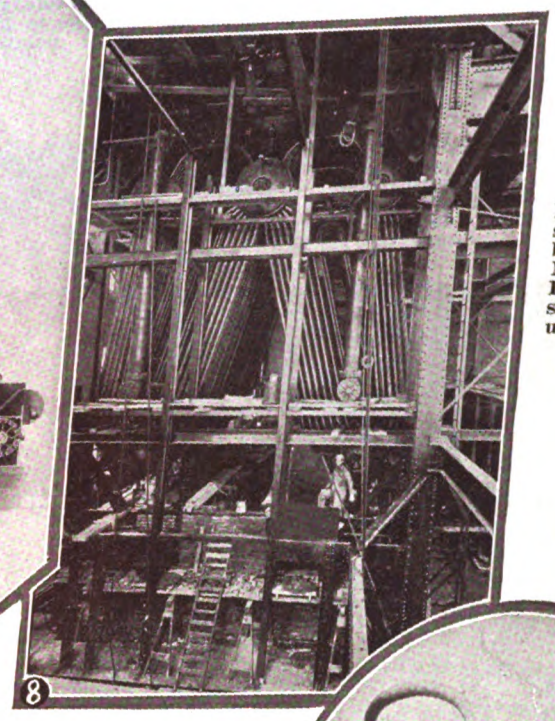


Fig. 8. A large installation of Stirling boilers in Power House No. 2 of the Detroit Edison Company, showing one of the units being equipped with superheaters.

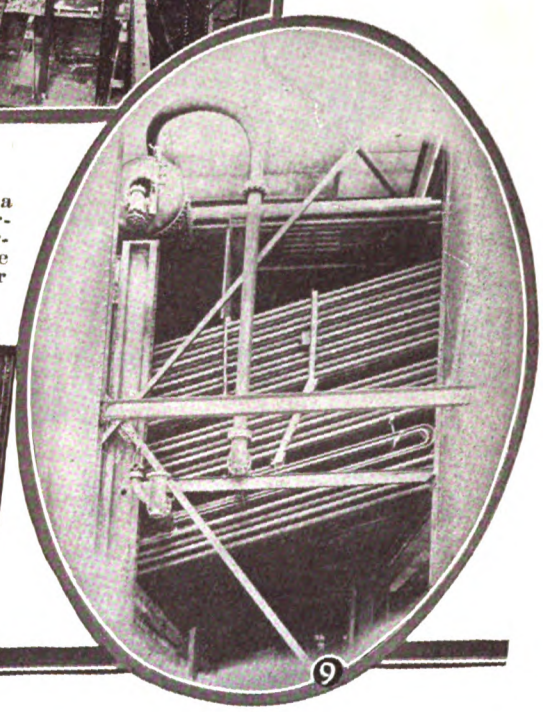


Fig. 9. A close-up view of a superheater showing an arrangement whereby the superheater is placed among the boiler tubes just above the lower rows.

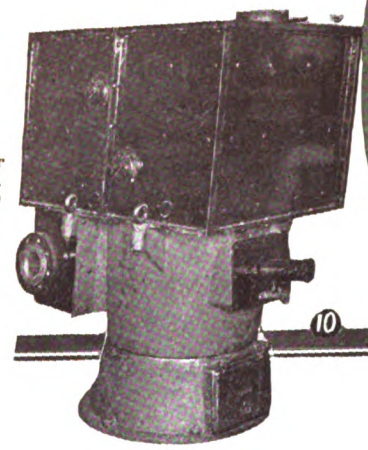


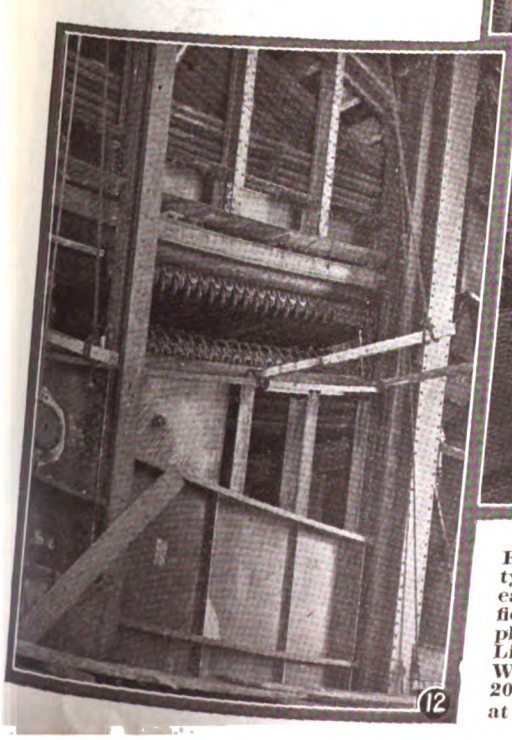
Fig. 10. A portable superheater unit which is separately fired. This unit has a capacity of 1000 pounds of steam per hour.

by the installation of additional devices for preventing heat and power losses that are inevitable with the existing outfit.

In effecting economies in the power plant, and more particularly in the boiler house, the opportunities offered by superheated steam for increasing the overall plant efficiency and thereby cutting fuel and power costs have not been neglected. There is probably no piece of boiler room apparatus, whose possibilities have been less appreciated and which gives less trouble to the operating men than a properly designed and located superheater. At the same time, under the right conditions, it is an effective means for more effectively using the generated steam power and for preventing many of the small losses, which added together often represent a considerable money value.

Considering the boiler as a power house unit by itself, it usually consists of suitable drums, headers and banks of tubes, designed to present a maximum of heating surface to the hot furnace gases for the purpose of rapidly and efficiently evaporating water and generating steam under pressure. The rapid circulation and violent boiling of the water within the boiler shell produces a fine mist or spray, which is often present in the steam as it leaves the boiler. Under such conditions the steam is said to be "wet." When there is no moisture in the steam it is said to be "dry" or "dry saturated."

Steam that is "dry" when



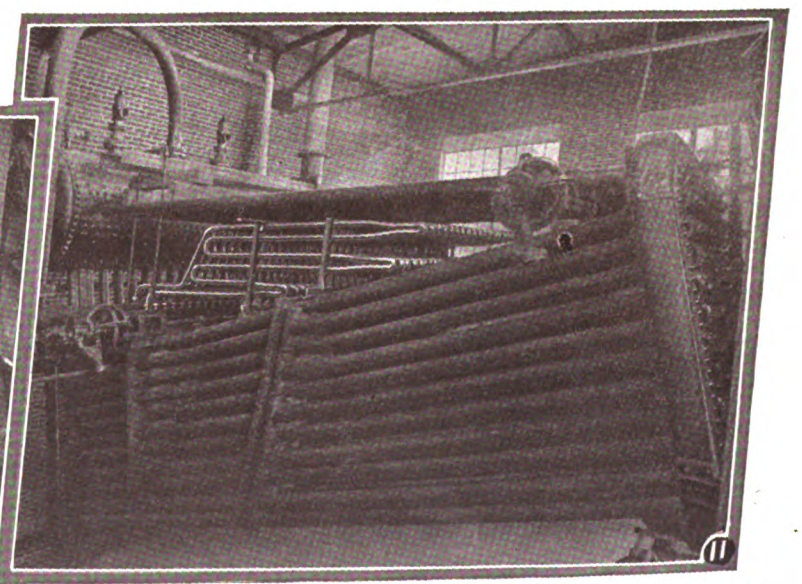


Fig. 12. Close-up view of one type of superheater installed in each of twelve 1890 hp. Springfield boilers at the Hell Gate plant of the United Electric Light and Power Company. With the boilers operated at 200% rating steam is delivered at 225 lbs. pressure and 153 to 225 degrees superheat.

Fig. 11. This unit is one of three 355 hp. Keeler cross drum boilers for the Borough of Chambersburg, Chambersburg, Pa. These units are designed to deliver steam at 190 lb. pressure and 100 deg. superheat when operating at rated capacity.

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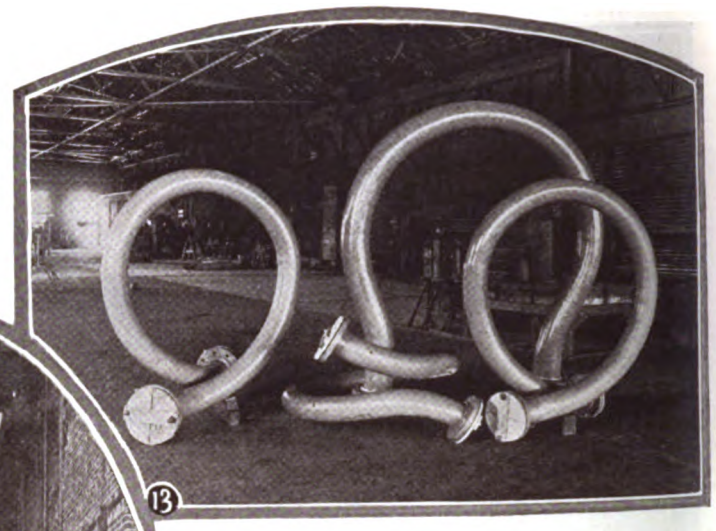


Fig. 13. Some of the types of pipe bends which it is sometimes necessary to install in lines carrying superheated steam to provide properly for extra expansion due to higher steam temperatures.

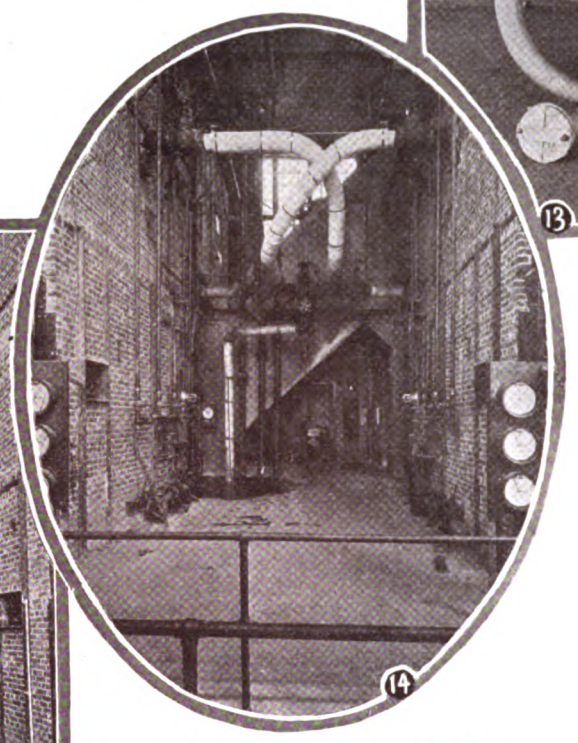
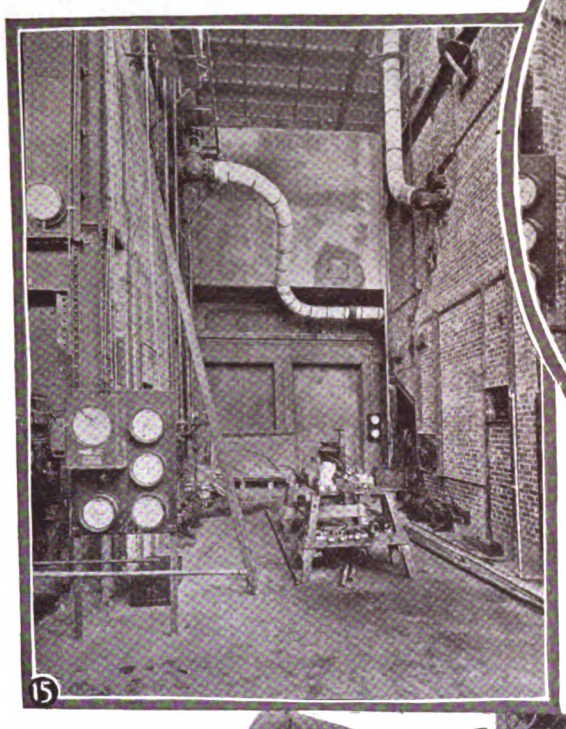


Fig. 14. Showing some of the bends in piping connections from the superheater to the main header to provide for easy flow of the steam.

Fig. 15. Another view of a well insulated pipe connection from superheater to header. Before the installation is completed valves and fittings will also be insulated to preserve the superheat.



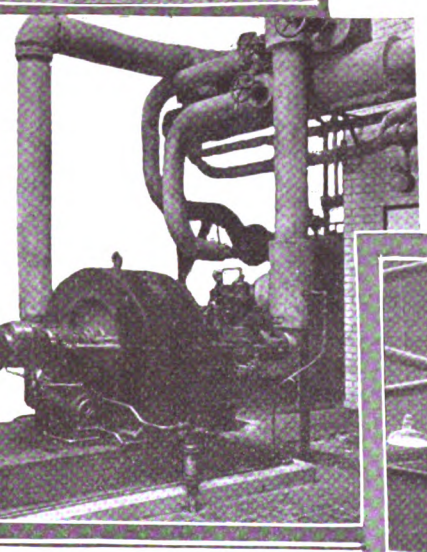
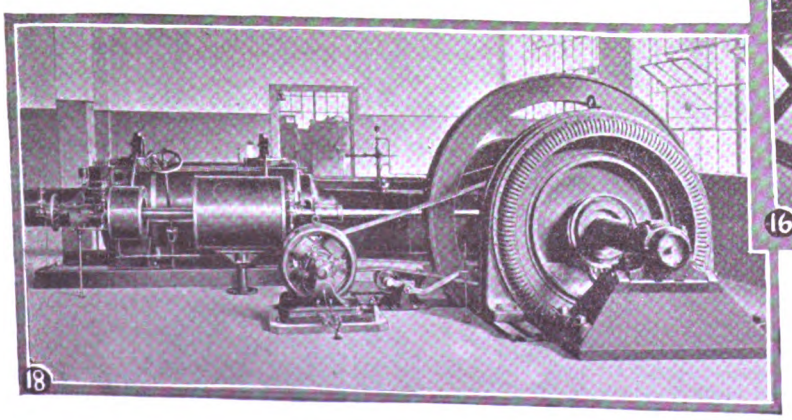


Fig. 17. A typical turbine lighting unit such as are found in many industrial plants. This unit operates on 200 degrees superheat, assuring that economy of which steam turbines are capable.

Fig. 18. A medium-sized engine of the "uniflow" type which is designed with a particular view to economy and the elimination of cylinder condensation. When using superheated steam as compared with saturated steam more than 10 per cent. saving is often possible.



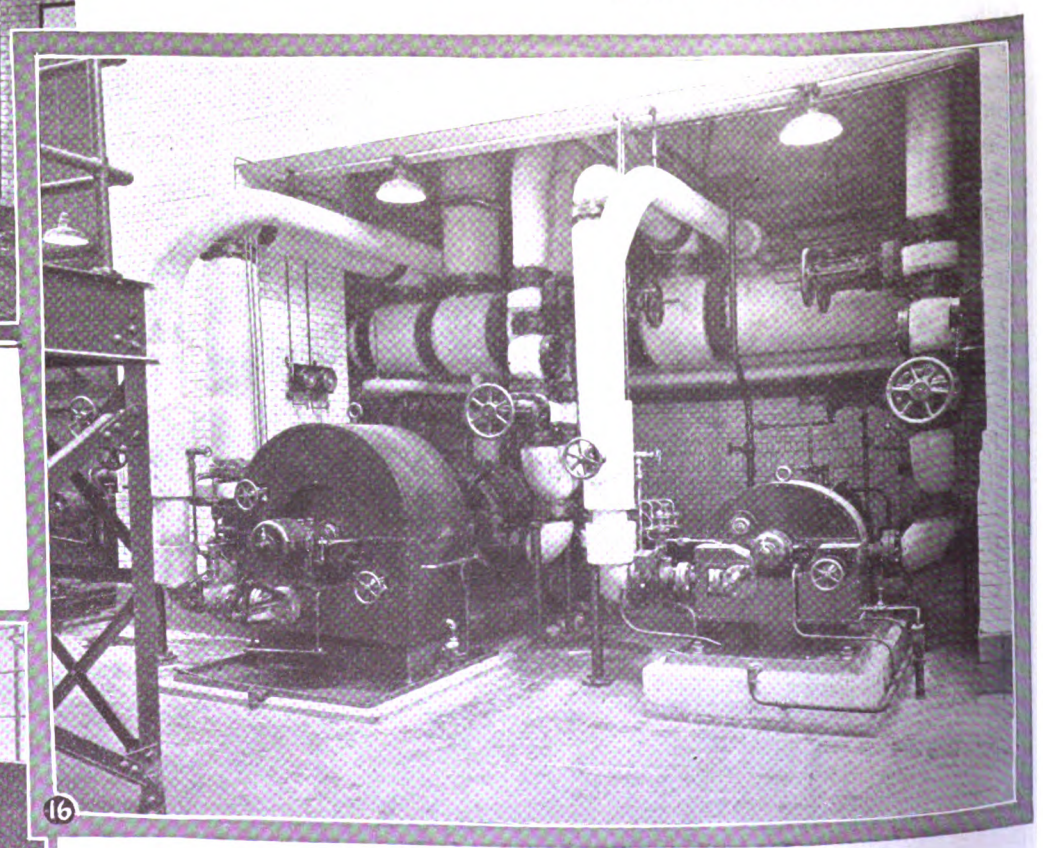


Fig. 16. Some of the small power plant auxiliaries, particularly the steam turbines, are not economical without superheat. This installation shows turbines designed to operate at 250 pounds steam pressure on 200 degrees superheat.

it leaves the boiler may become "wet" before it reaches the engines by coming in contact with the metal surfaces of the steam pipe lines which permit heat to pass from the steam to the surrounding air. This radiation causes a cooling effect within the steam itself and produces condensation and "wetness." Well insulated pipe lines reduce this condensation to a minimum.

Sudden reductions in steam pressure, such as occur when steam expands in the cylinders of reciprocating engines or in passing through the blades of steam turbines, also have the effect of producing condensation and causing "wetness." The greatest factor in cylinder condensation, however, is the heat lost when the hot steam

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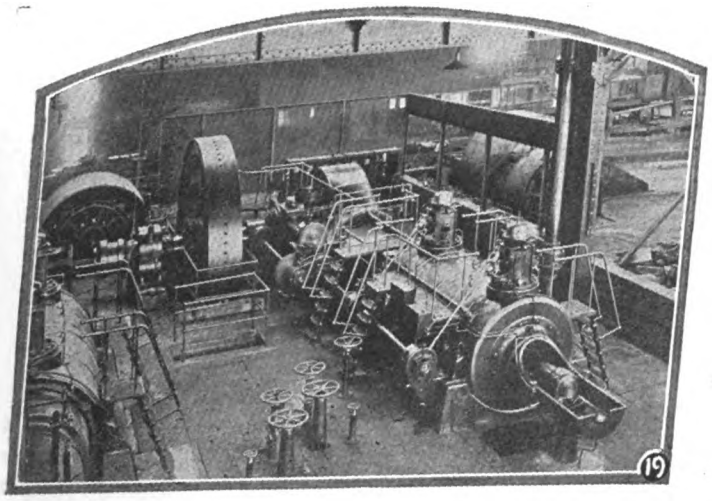


Fig. 19. A very large economical engine of the "unaflow" type designed to operate with 75 degrees superheat and effecting a consequent saving of approximately 12 per cent.

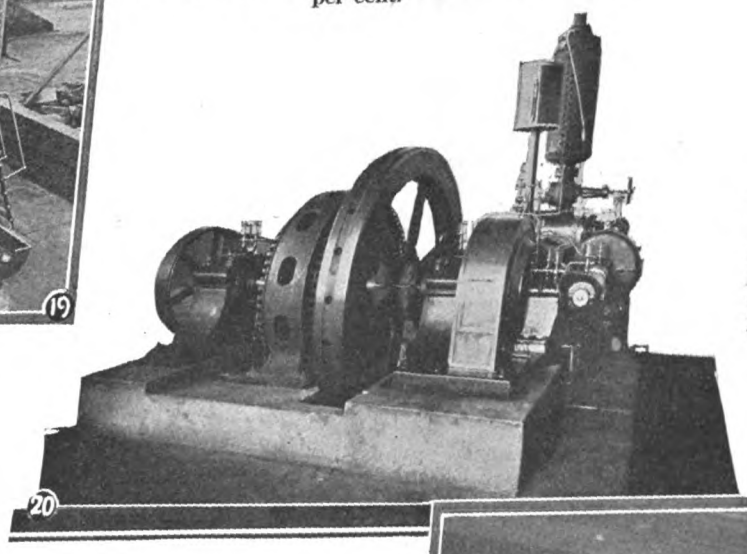


Fig. 20. Small engine units are particularly well adapted to use with superheated steam. Modern engine design has made rapid strides and engines such as shown in this illustration are capable of very high economy when using superheated steam.

comes in contact with the relatively cool walls and internal surfaces of the cylinder and piston. In this connection it must be borne in mind that the internal surfaces of a pipe line may be maintained at a more or less constant temperature, while the cylinder walls are alternately heated by incoming live steam and cooled by outgoing exhaust steam, the expansion of which has caused a marked reduction in temperature. Sometimes this cylinder condensation amounts to 20 per cent of the total weight of the steam.

Since the ability of steam to do work and generate power depends upon its expansive properties, it is obvious that it will be effective and useful only so long as it remains in the

(Continued on page 40)

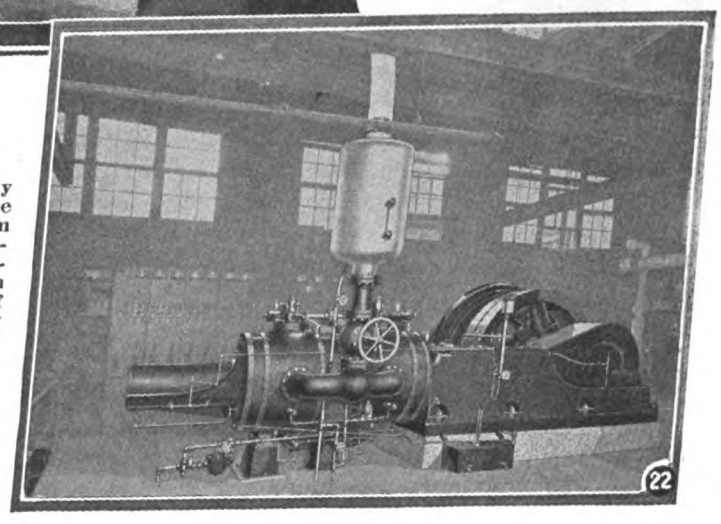


Fig. 22. Showing an unusually economical engine unit of the "unaflow" type. Note the steam separator in the steam line to prevent moisture and other impurities entering the cylinder. With superheated steam the presence of moisture in the steam is practically eliminated.

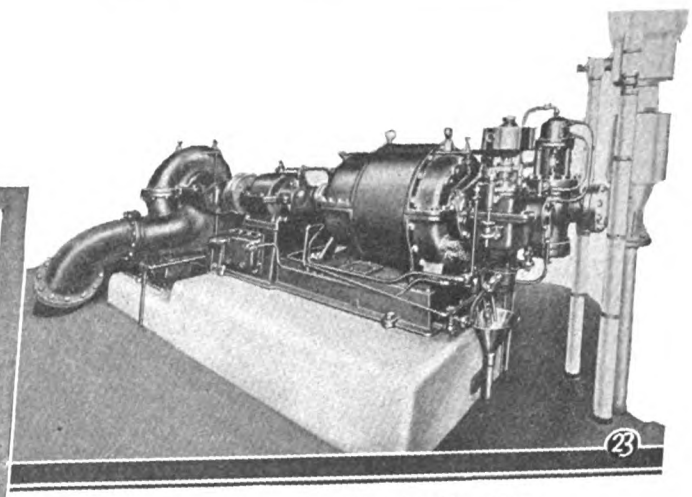


Fig. 23. A 145-horsepower turbine driving a centrifugal pump through reduction gearing—pumping 1,800 gallons per minute against a 165-foot head.

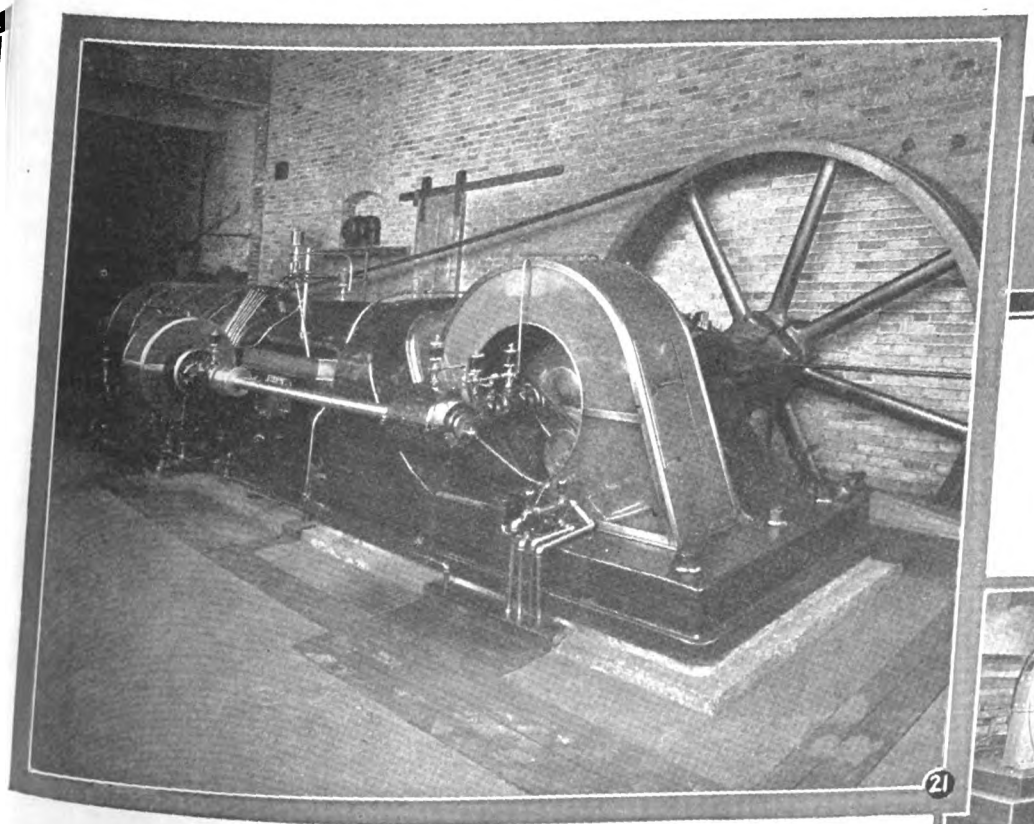
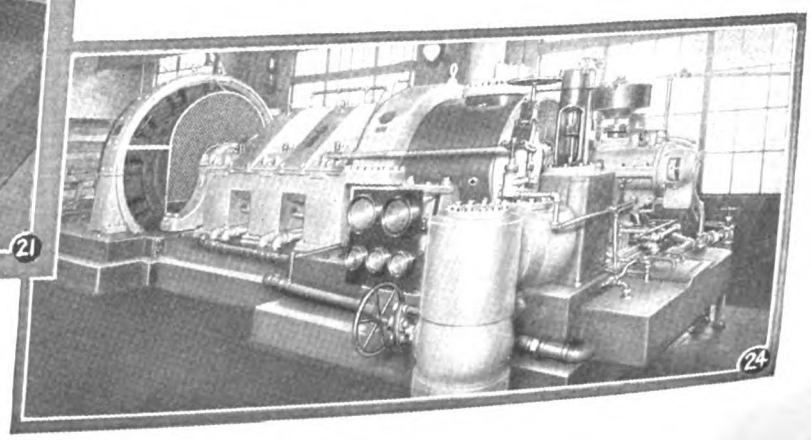


Fig. 21. Another small engine unit designed for operation with superheated steam with the idea of eliminating cylinder condensation and increasing the efficiency thereby.



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Where Minutes Are Vital

How Modern Production Methods Are Applied to a Newspaper

By W. Thomson Lees



Fig. 1. In the third railed enclosure, above, the Managing Editor has his desk. In the far corner are the quarters of the editorial writers.

IT is an unchallenged boast of the *New York Tribune* that copies of that paper were on the street, announcing the death of President Harding, some fifteen to twenty minutes before any other metropolitan daily was able to disseminate the sad tidings. In the publication of a daily newspaper it is minutes—not hours or days—that count. News, like time or tide, waits for no man; and the one overshadowing task of the newspaper man is to get the news into print quickly, just as soon as possible after its occurrence.

The feat of the *Tribune* was not mere luck; it was, on the contrary, tangible proof of the success of years of research and careful planning which culminated in the marvellous new plant on 40th Street, New York.

Throughout this plant there is evidence of two things: that a newspaper, in spite of all tradition to the contrary, *can* be made amenable to the principles of modern, efficient production; and that this efficiency can be made to go hand in hand with comfort and cleanliness



Fig. 2. Well lighted, well ventilated, cheerful offices are no small factor in getting things done.

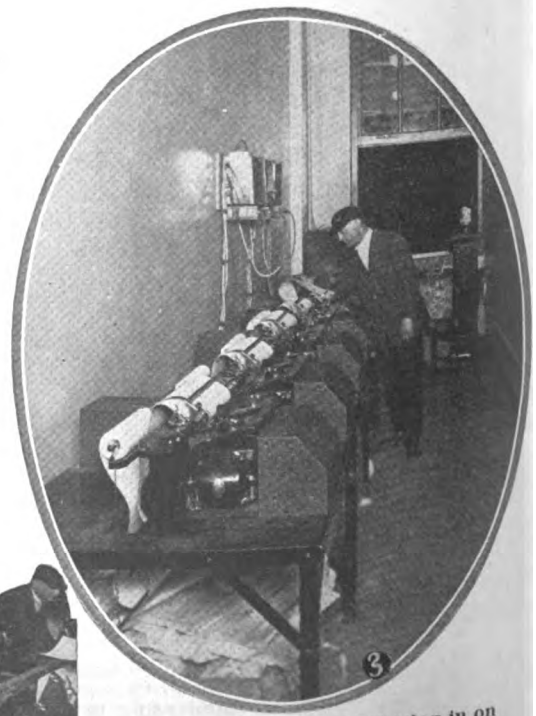


Fig. 3. News tickers, bringing in on automatic printers the grist of the outside news-gathering agencies are installed in a separate room because of their noise.

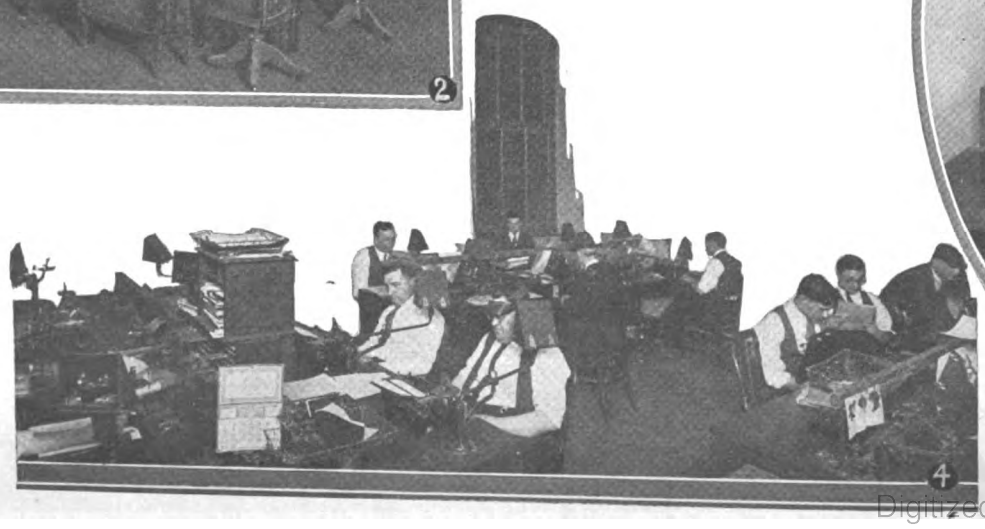


Fig. 4. The telegraph room, with its twenty-five direct wires to all points of the compass, keeps the editorial finger on the pulse of the world.

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Fig. 5. From here—the City room—on the fifth floor, the news begins its journey by gravity from the U-shaped copy desk.



Fig. 6. Here is a part of the composing room, where copy is set up in type and then made up into pages; the type matter being locked in steel forms preparatory to stereotyping.



Fig. 7. A few of the battery of fifty linotype machines with electrically heated melting pots. It is here that the special ceiling, described in the text, deadens sound.



Fig. 8. In the make-up section of the fifth floor, showing more clearly the steel tables on which pages of type-matter are made up. These "forms" of type are wheeled (see Fig. 9) to the steam room.

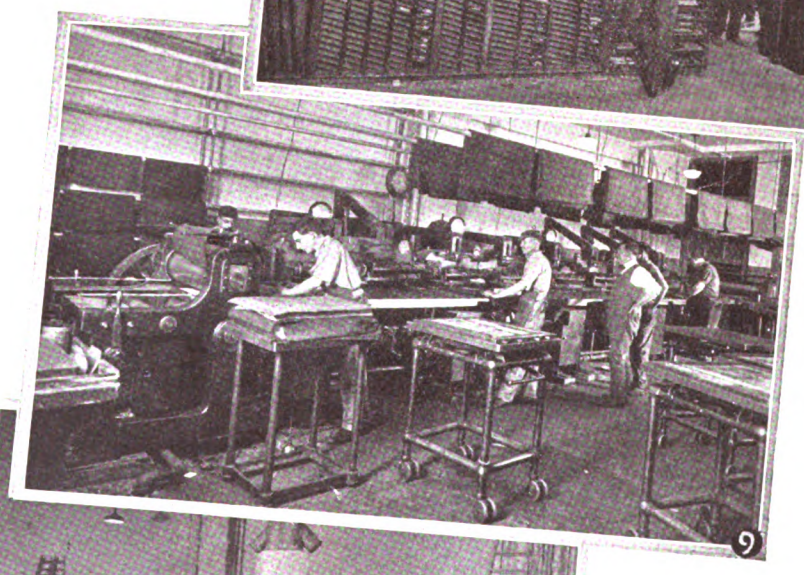


Fig. 9. In the steam room, a papier-mache impression is taken of the type form, under pressure. These papier-mache molds, or "mats," are dropped down a chute to the floor below.



Fig. 10. In the background is the chute from the steam room. The mats are placed in sterotype casters, which produce the curved plates from which the actual printing is done. This room, with its heat and fumes, is separated from the press-room only by a canopy wall; yet the press-room is free from any of the stereotype-room atmosphere (see text).

and pleasant working conditions.

Basically, this most up-to-date plant is planned upon what industrial executives have come to know so well—the straight line-gravity system. Production moves, on each floor, in as nearly as possible a straight line; and, through the entire building, downward to street-level. The advantages of this system are obvious; the application of the system to such a complicated process as the production of a metropolitan daily, however, is not such a simple matter.

For example, the gravity-production-flow plan requires that the presses be located on the third floor. Yet, the huge presses required are of such weight that, at the present writing, only four plants of all the newspaper publishers in the East—have successfully installed their presses on the third floor.

Again, from a time-saving standpoint, the stereotype room should be near the presses; and with unobstructed passage from the former to the latter, so that plates can be put on the press without delay. But the heat and gases incident to the stereotype process are not only detrimental to the press, but furnish an atmos-

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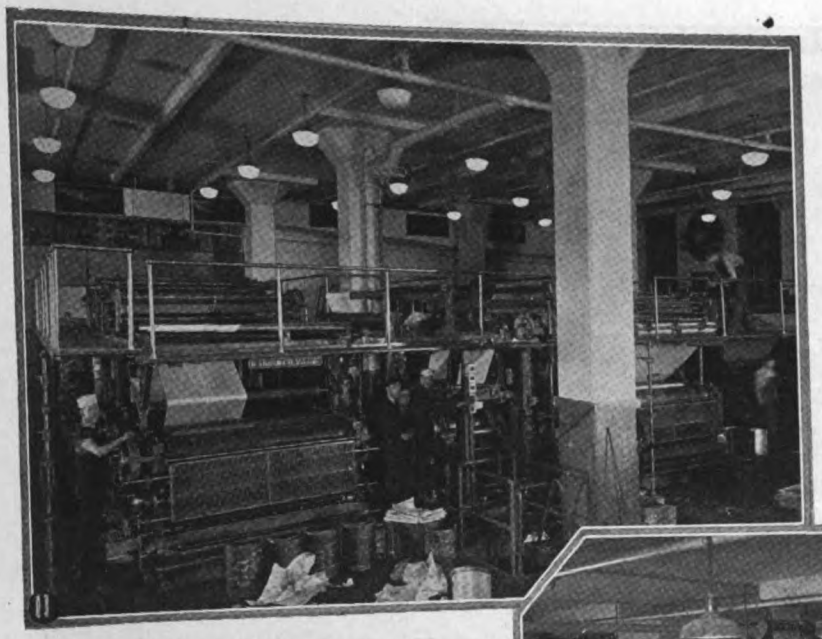


Fig. 11. The huge presses are on the third floor, which has been designed to carry safely a load of 1,100 pounds per square foot. The oft-dramatized "angry vibration of the roaring presses" has gone the way of the romantic horsedrawn fire engine.

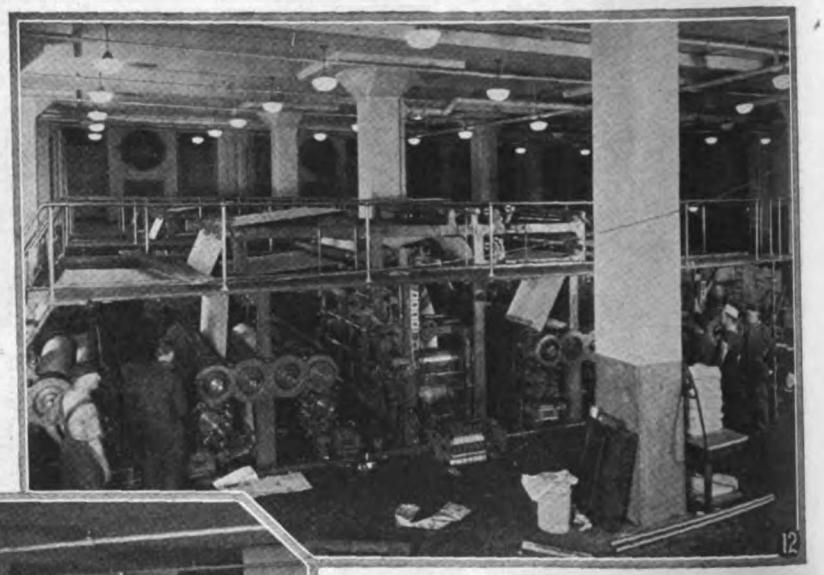


Fig. 12. Stereotype plates are delivered at one end of the presses, paper-rolls feed from below, and the printed, folded, pasted, counted newspapers are picked up by dispatch conveyors such as shown in the middle foreground above.



Fig. 13. Three of the dispatch conveyors are visible here, at the delivery end, with some of the sorting tables in the foreground. This, of course, is at street-level.



Fig. 14. Trucks back right up to the shipping platform of the sorting-room floor.

Fig. 15. The paper storage (basement) is designed for handling the heavy rolls with minimum labor and delay.

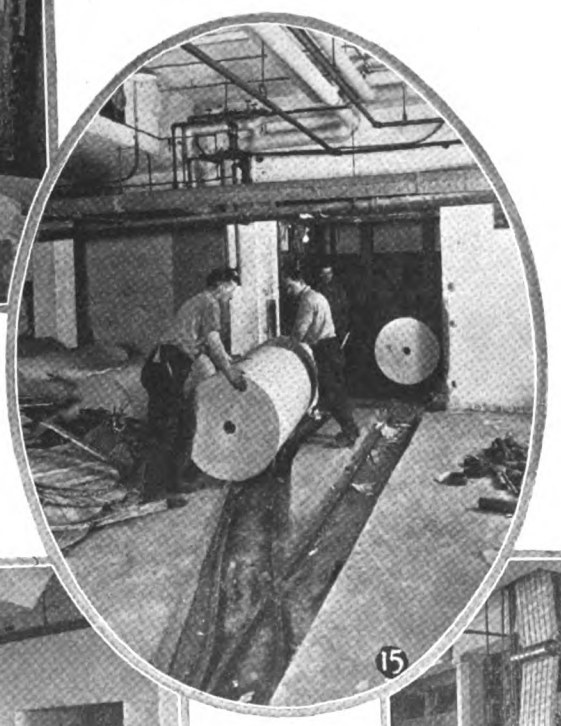




Fig. 16. The chute, by which the 1200-pound rolls of paper come from the delivery trucks to the Tribune's paper storage department.

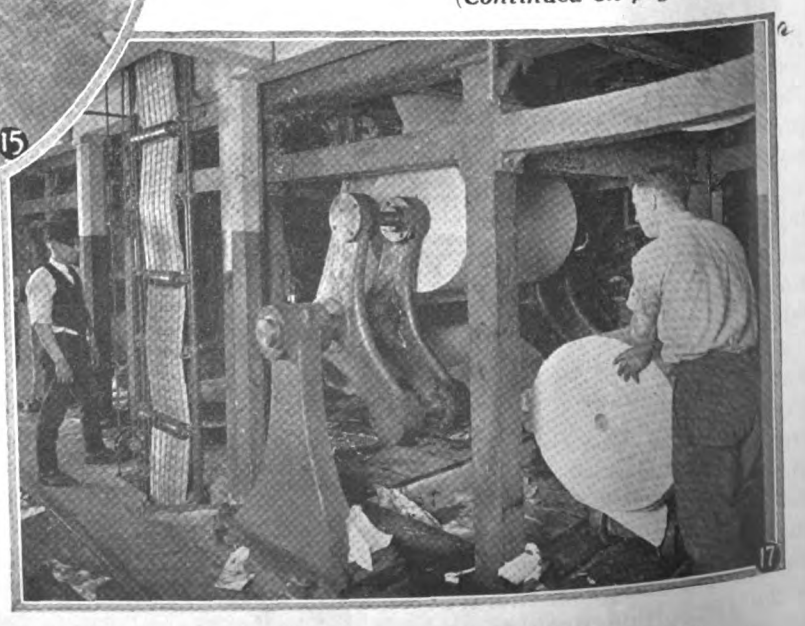


Fig. 17. Fresh rolls of paper are put in under the presses while they are running. Note the dispatch conveyor taking finished papers to the ground floor.

phere in which good printing is impossible. Here is where modern ventilating and air-conditioning science accomplishes a seeming impossibility. There is a thin partition extending clear across from the ceiling downward, *but not all the way to the floor;* in fact, there is unobstructed passage between press and stereotype departments, with plenty of head-room under the partition. And yet, by means of the ventilating apparatus in the latter and the air-conditioning equipment, the press room is kept at an even temperature and quite free from the heat and gases incident to the stereotyping process. So marked is the effect of this ingenious system, that one can stand immediately under the partition and, by moving a single step to one side or the other, experience a complete

(*Continued on page 45*)

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670,000 Horsepower of Electric Heat

What Electricity Has Done for Industrial Heating

BY B. S. BEACH

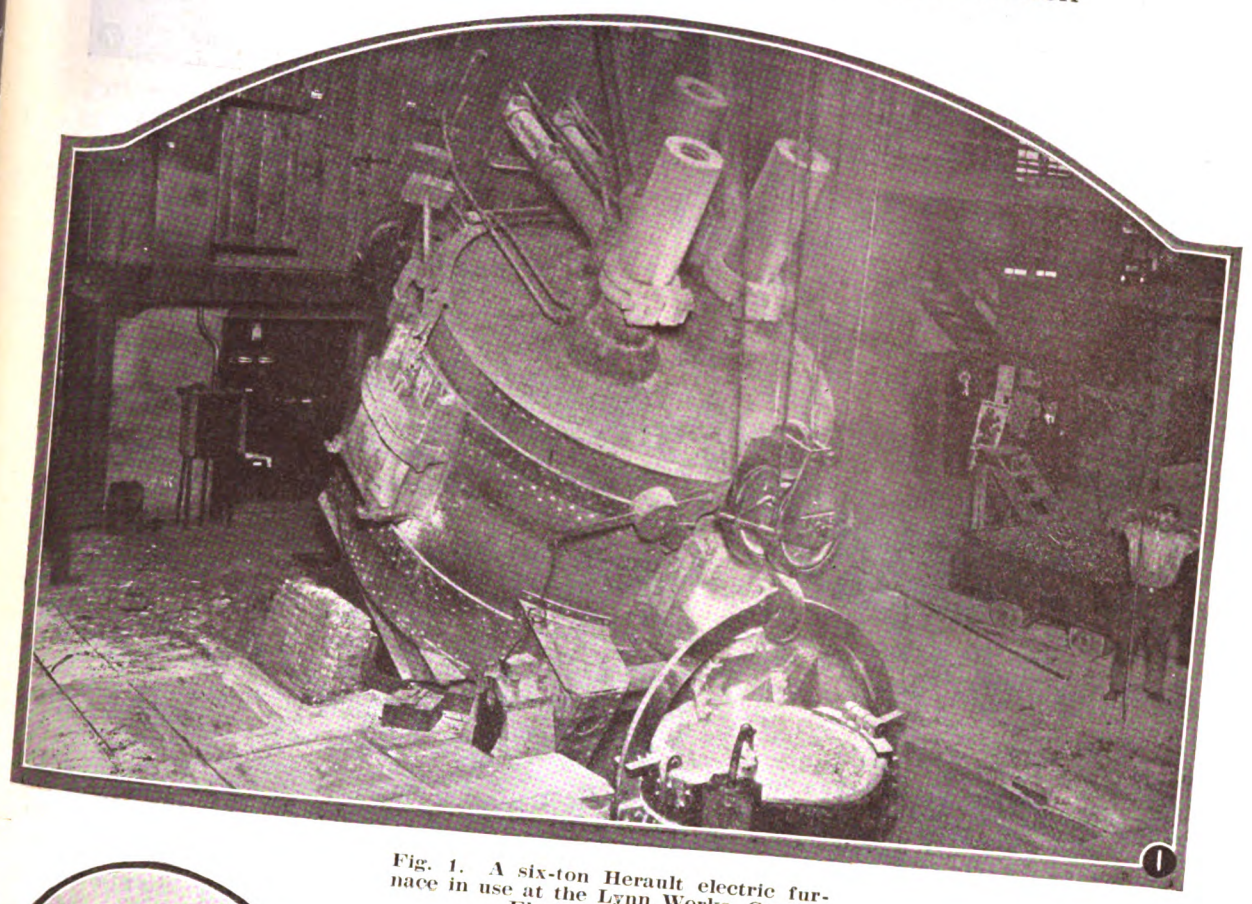


Fig. 1. A six-ton Herault electric furnace in use at the Lynn Works, General Electric Company.

IT is only within the past decade that engineers have come to the realization that heat, generated by electricity has enormous possibilities of industrial development. Of course it has always been known that electricty passing through a wire created heat of varying degrees and intensity, but formerly this was considered more in the light of an unavoidable nuisance than otherwise.

As the electrical industry developed, however, and central stations of ever-increasing size were built, engineers began to look for means whereby these stations could sell their electricity to the best advantage to themselves and the customers they served. This resulted in the rapid development of electric heating devices until today more than 500,000 kw. or 670,000 hp. is used for industrial purposes alone in the United States. This figure represents over 7½% of the electric energy used for all other industrial uses for it has recently been estimated that about 9,000,000 hp. is used by electric motors in manufacturing in the United States.



Fig. 2. Special applications of electric heat are what have widened its use. Here is a mica mold heating oven.

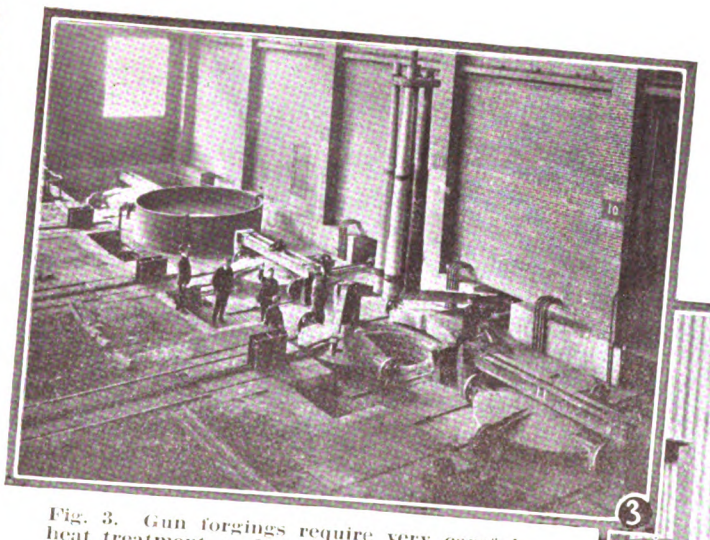


Fig. 3. Gun forgings require very careful heat treatment, and the delicate control of electric heat is a big advantage. These furnaces are installed at the Tioga Steel and Iron Co., Philadelphia.

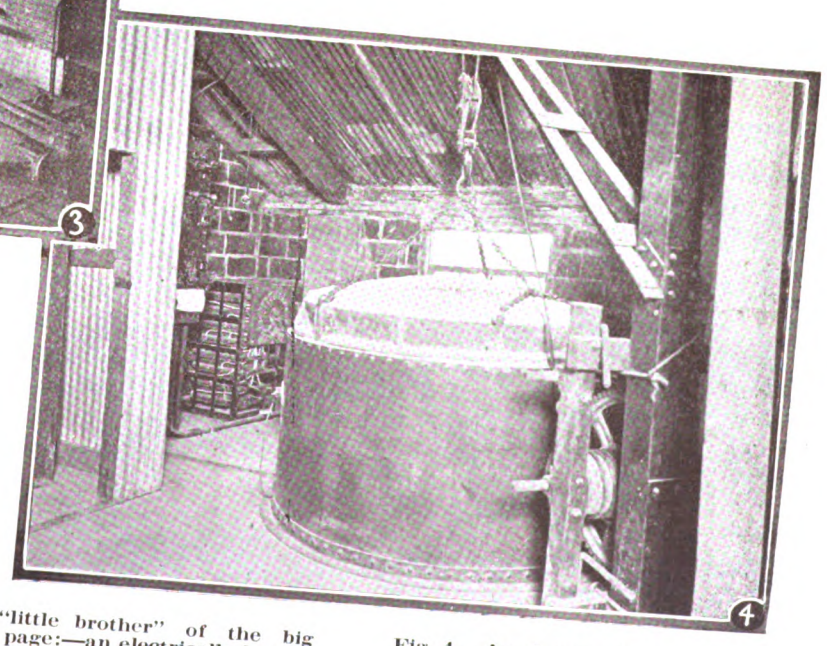


Fig. 4. An electric glass annealing furnace, equipped with automatic temperature control.



Fig. 5. The "little brother" of the big fellows on this page:—an electrically heated water-packeted glue pot.

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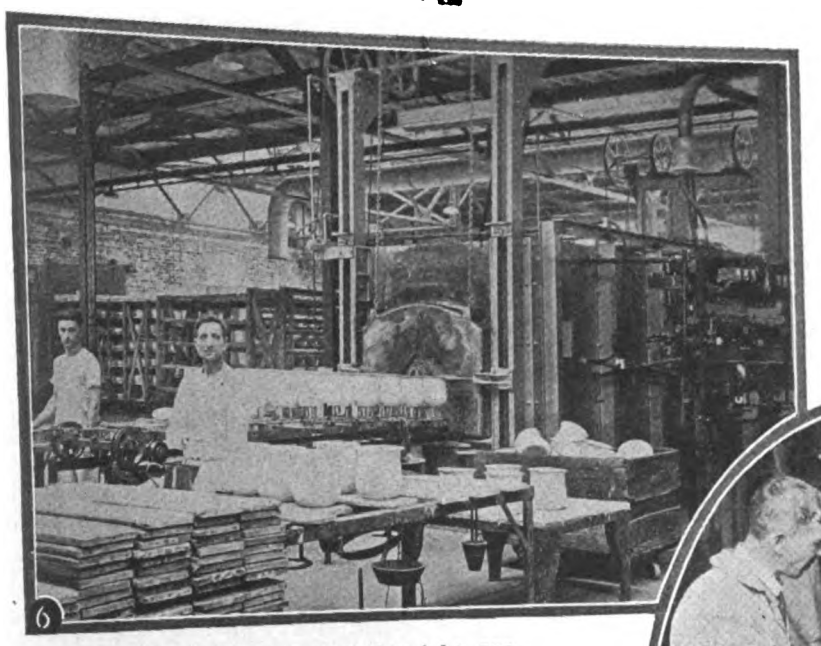


Fig. 6. Here, and at the right, are views of an electrically heated furnace for vitreous enameling.

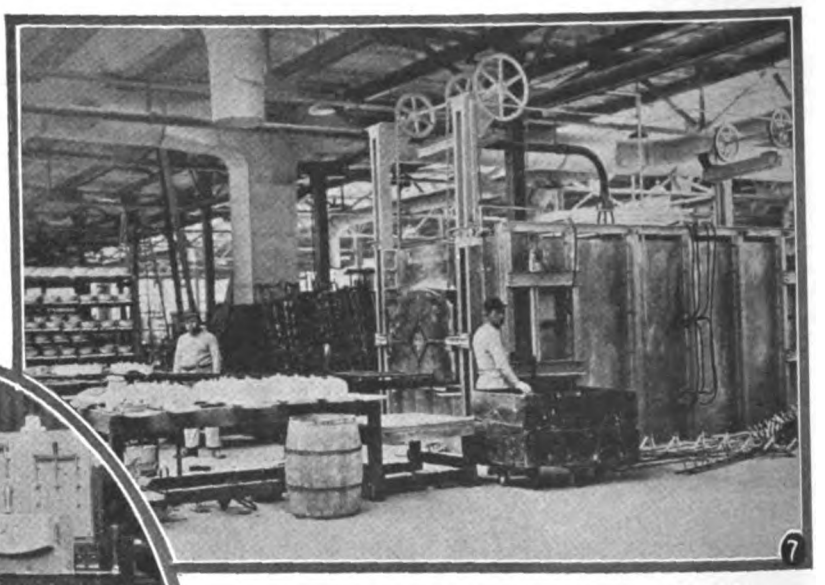


Fig. 7. Another view of the double chamber vitreous enameling furnace of Fig. 6. This is installed at the Coonley Mfg. Co., Cicero, Ill.

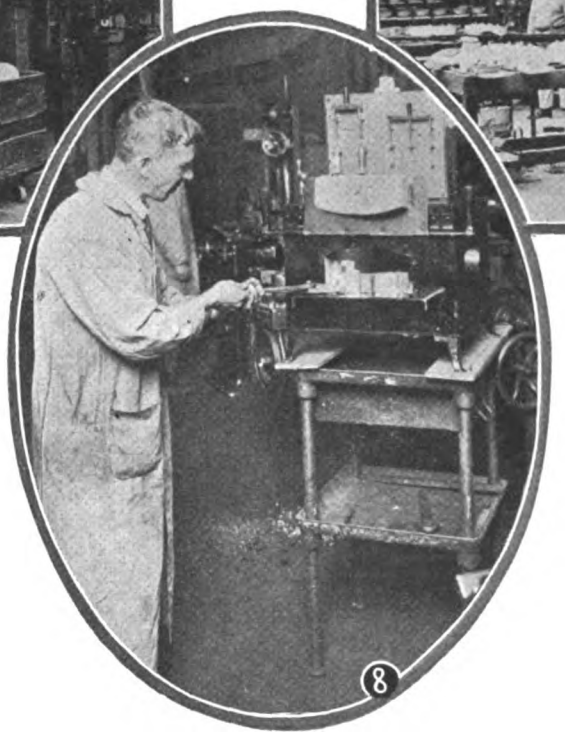


Fig. 8. Muffle-type heat treating furnace, for small work.

The principal factor contributing to the increased use of electric heating appliances is the way in which they answer the modern demand for conservation — conservation not only in the saving of natural resources, but the saving of time, materials and the reduction of the uncertain "personal element" to a minimum as well as the improvement of the product. Despite the fact that the conversion of fuel into electric heat is only reached after a long and complicated series of steps, whose ultimate efficiency is but 20%, it has met requirements so well that, in time, it will undoubtedly replace the use of fuel heating to an enormous extent. At Niagara Falls for example, fully 90% of the energy now generated is used for industrial heating purposes. In fact, its development in recent years has gained such headway that it bids fair to surpass, in energy consumption, both the light and power branches of electrical service together.

With the enormous amount of undeveloped hydraulic power in the country, it is not easy to predict where the final stopping point will be, because it is by water power that electrical energy can be most efficiently developed as regards money input versus output. The limits to the use of electricity, produced hydraulically, can be grasped only when it is realized that there is one hundred and twelve million potential horsepower on the continent of North America still undeveloped.

Most industrial heating of former days was obtained through three mediums—coal, oil or gas. Taking coal as an example in reaching the exceedingly high temperature necessary in some processes, 88% of the B. t. u., or heat units in a pound of coal are used up in merely raising the fuel and the excess air of the furnace to the required temperature, thus wasting the natural resources upon which we depend so much, and making the average industrial town

Fig. 9. Japan baking ovens at the Chevrolet Motor Company plant, Tarrytown, N. Y.

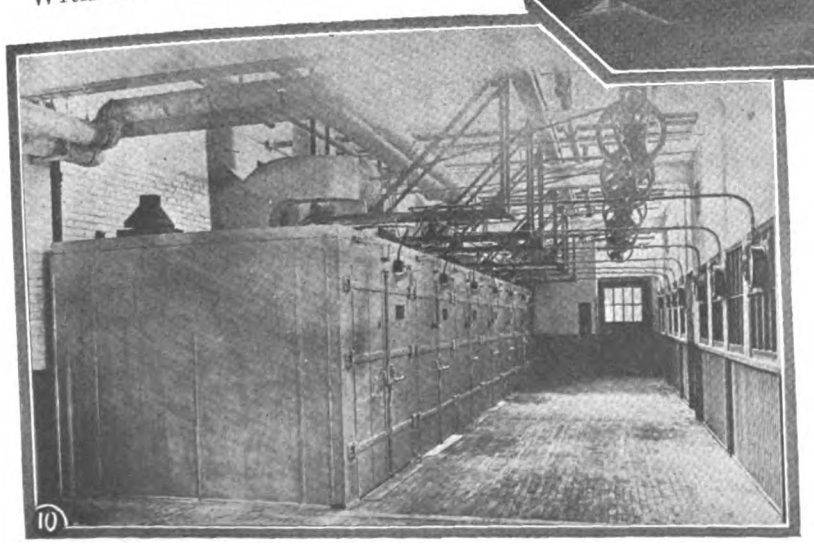


Fig. 10. A battery of ten japan baking ovens in use for general japanning, at the Ritter Dental Mfg. Co., Rochester, N. Y.



Fig. 11. Wire baking ovens, equipped with automatic control, at the Halcomb Steel Company, Syracuse, N. Y.

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anything but a healthy or pleasant place in which to live.

With electrical heat, temperatures that are impossible to fuel-generated heat are reached quickly, economically, and without any consequent defilement of the surrounding atmosphere. Along the same line of conservation, manufacturers are beginning to realize that the elimination of spoiled, and unfit products, whether rendered so by inefficient and unreliable methods of heating, or by careless employees, is just as much conservation as anything else. Also the elimination of unnecessary labor, and the establishment of cleaner, safer working conditions tend toward the attainment of the rapid rate of production which is the paramount demand of the present industrial era.



Fig. 12. The sherardizing process, with its importance as a rust preventive, has led to the design of such machines as this 40-inch electric sherardizing machine.

Thus the variety of processes to which electric heat is applicable has given rise to many devices for its use, ranging all the way from a metal melting furnace, whose production is 18,000 lbs. per day, through the oven field, to small metal melting pots with a capacity of 25 pounds of metal. In the domestic field 25,000 electric ranges and an uncounted number of small household appliances are in use. All furnaces, ovens, etc., are remarkable for their reliability, economy and the perfection of their finished products.

To take the brass furnace as a typical example of what can be done by the application of electric heat in overcoming the difficulties of specialized operation, in the fuel-heated brass furnace, one of the greatest drawbacks is the loss of zinc through volatilization and oxidation due to the high temperature of the applied heat, as well as the atmospheric conditions surrounding the bath.

In the electrically heated brass furnace both these conditions are absolutely under the control of the operator. There are several types of brass furnaces in use today—namely—the arc type, which has no automatic control but a low first cost; the induction, which just fits a field where productions can be placed on a 24-hour basis; the carbon resistor, best for temperatures not exceeding 1,000 C; and the muffled arc type, more expensive, but the only one that can be operated automatically.

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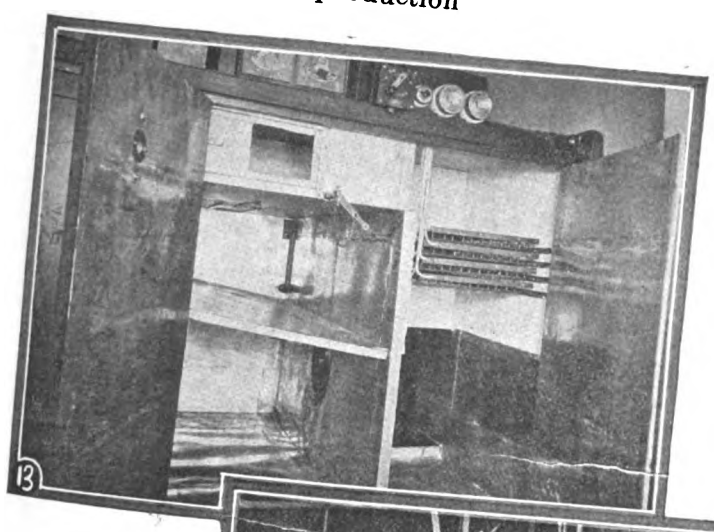


Fig. 13. The Detroit News Company, Detroit, Mich., uses this electric oven in the production of electrotypes.

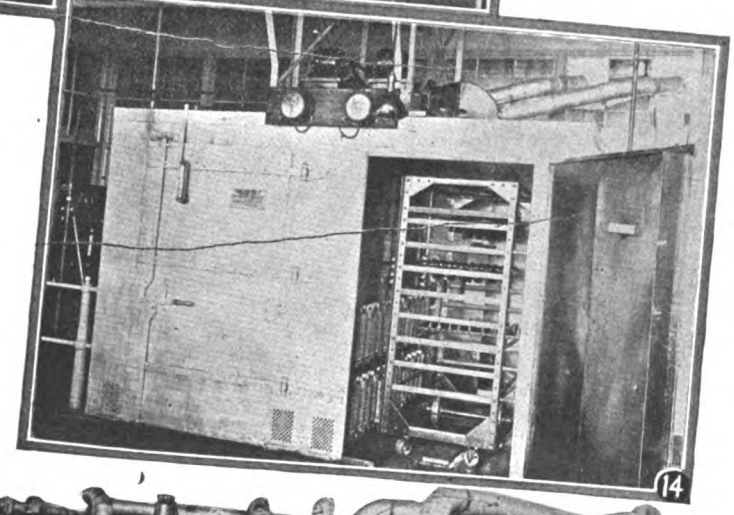


Fig. 14. These enameling ovens are a part of the production equipment at the plant of the Rausch & Lomb Optical Co., Rochester, N. Y.

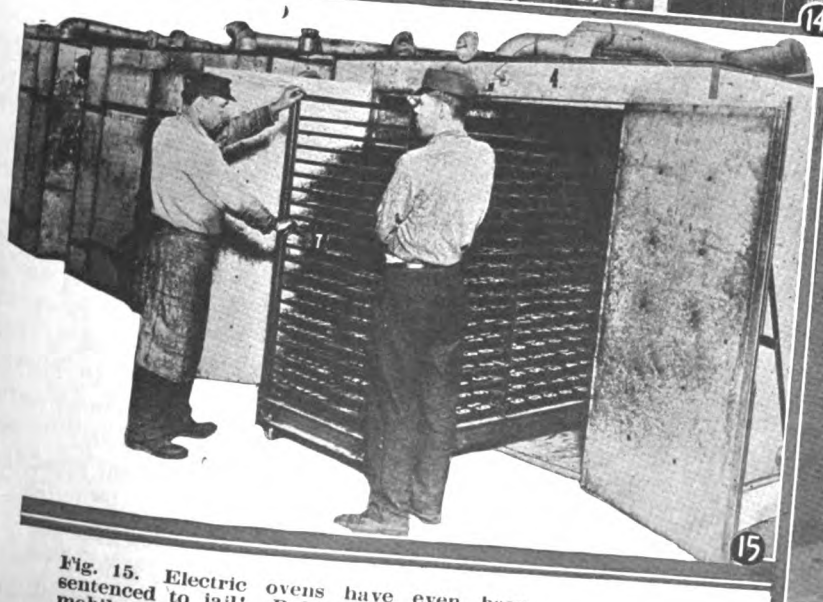


Fig. 15. Electric ovens have even been sentenced to jail! Baking japan on automobile license tags, Ohio State Penitentiary.

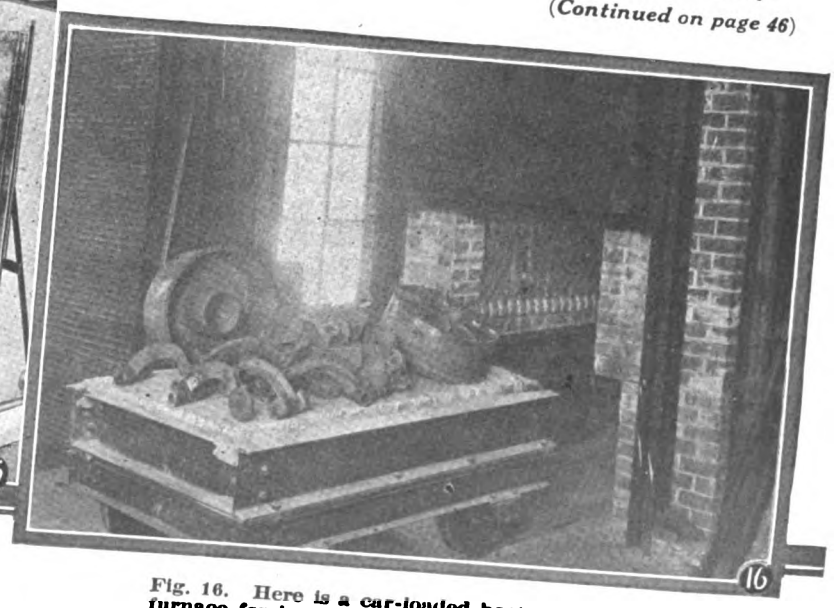


Fig. 16. Here is a car-loaded heat-treating furnace for heavy parts, at the Connecticut Electric Steel Co., Hartford, Conn.

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The Petroleum In

BY ROY

Manager of Industrial Relations

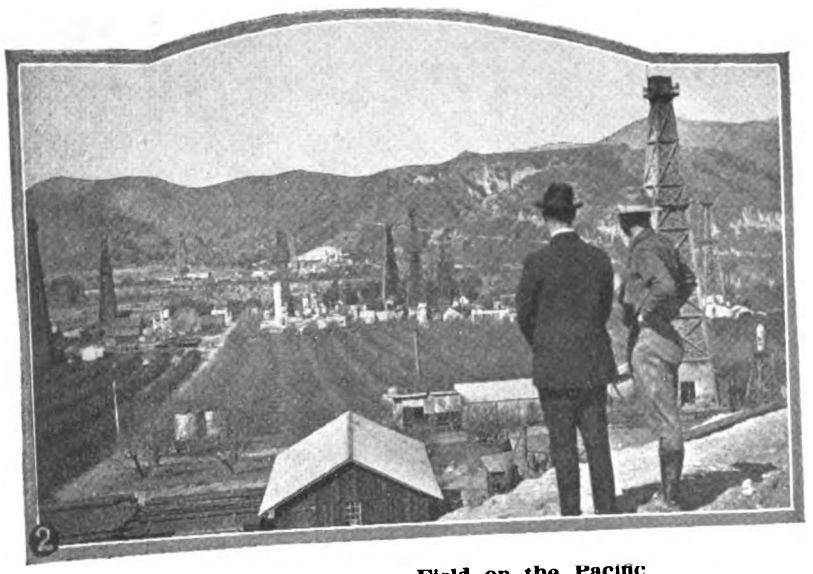


Fig. 2. Part of the Ventura Field on the Pacific Coast, near Ventura, Calif. This is one of the promising newer fields and has the only large producing wells near the coast line north of Los Angeles and Orange Counties.

BECAUSE of its strategic position in world oil operations, the California petroleum industry is especially worthy of study. From its romantic beginning to the present place of leadership among the states producing oil, the story is full of dramatic episodes. In what follows, we have tried to sketch only the essential features which are determining the present trend in California oil circles.

The most spectacular change occurring in the petroleum situation during recent months has been an unparalleled increase in the production of light refinable crudes in Southern California. On January 1st, 1921, there were forty-three producing companies south of Tehachapi Pass. In January, 1923, there were one hundred and seventy-five individual and corporate producers in Los Angeles and Orange Counties, where three great new oil fields had been discovered at Santa Fe Springs, Huntington Beach and Long Beach, and several other smaller fields, all highly productive, were being rapidly drilled. The flush production taken from the three most intensively drilled territories exceeded 41,000,000 barrels. In the space of only a few months $58,000,000 were spent in drilling and other field operations.

In sixteen months, from January 1, 1921, to May 1, 1923, this limited area produced 90,700,000 barrels, thus nearly equalling the annual production of California in 1917. Largely because of these new fields, the annual production of the State jumped from 114,

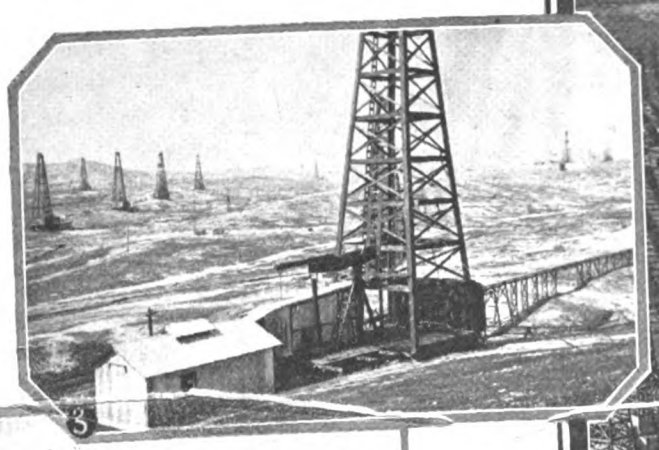


Fig. 3. A modern pumping equipment in the Kern River fields. The pump is operated by an individual motor. The oil is carried away by an open flume system which allows the sand and water to be separated before it reaches the shipping tanks.

Fig. 4. A jack plant used for operating a large number of small producers in one of the older fields. This is the most economical method of pumping oil.



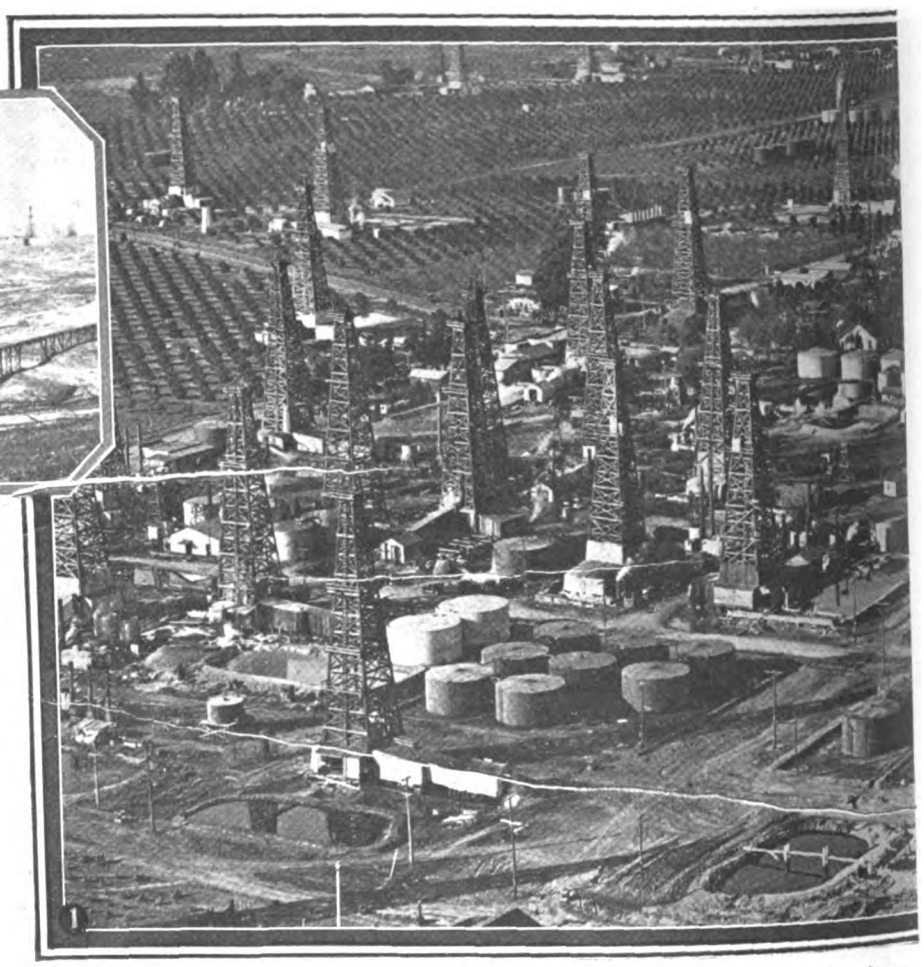


Fig. 1. An airplane view of a section of the Santa Fe Springs field, near Los Angeles. These wells average an initial production exceeding 4,000 bbls. per day of high gravity oil.

Fig. 6. A typical absorption plant used to extract gasoline from the gas escaping from the well casing. The gasoline is absorbed by a special oil and later driven off by distillation.



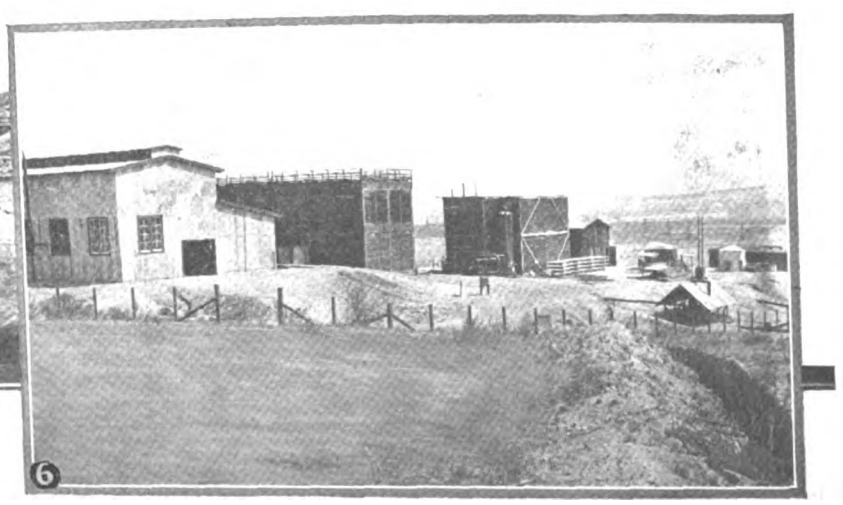


Fig. 5. A pipe-laying crew in the Elk Hills, not far from Taft.

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dustry in California

WILLMARTH KELLY

Associated Oil Company of California

850,000 bbls. in 1921 to 139,626,000 bbls. in 1922, this in spite of the fact that hundreds of wells in the older fields were not producing.

Because of their position in a rapidly expanding industry, managements of the various oil companies have been compelled to play the part of pioneers in many directions. Control of widely scattered organizations employing thousands of persons; development of machinery and processes suitable to rapidly changing demands; the attraction of capital in large amounts to enterprises of questionable security—all present grave difficulties.

The industry as a whole may be roughly divided into five major divisions, namely: producing fields, marine and pipe line transportation, refining, and marketing. To these must be added the general offices which serve the multifarious operations of each oil corporation.

In the past, fluctuation from the condition of over-supply to one of scarcity of crude oil, have caused serious losses to companies engaged in only one phase of the business. Thus, during one industrial cycle, the producer of crude is paying good returns on his investment while the refiner is losing money, and in the next cycle, the relative positions are quite the reverse. This situation led foresighted oil corporation managers to adopt a type of organization which enables a single corporation to drill and operate the wells, transport the crude, run refineries and distribute the finished products to the consumer.

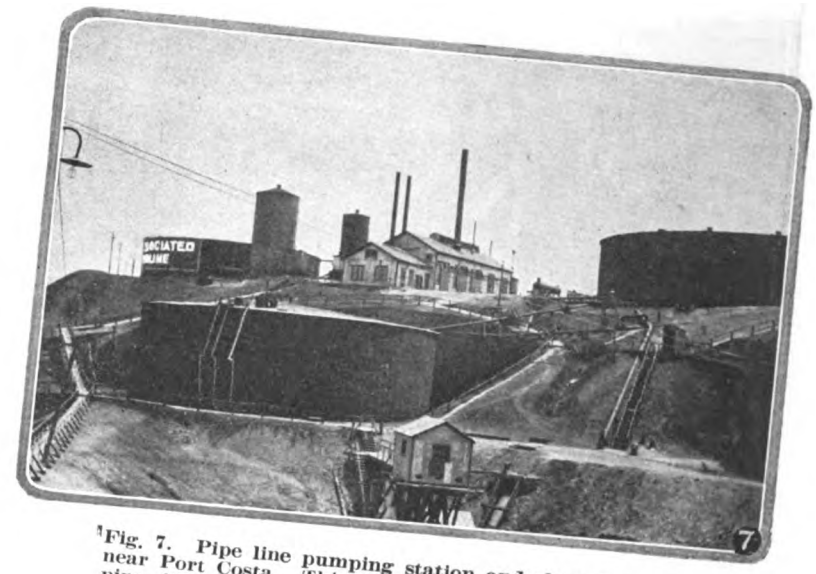


Fig. 7. Pipe line pumping station and shipping tanks near Port Costa. This station is supplied by two 8" pipe lines, with a total capacity of approximately 60,000 barrels per day. Vessels are loaded by gravitation from storage tanks 350 feet above the Bay, which pressure enables boats and cars to be loaded faster than at any other loading station in the world.





Fig. 8. Store yards and warehouses for oil field supplies, maintained by a large company.



Fig. 9. A typical California oil refinery, located on Suisun Bay, northern arm of San Francisco Bay.

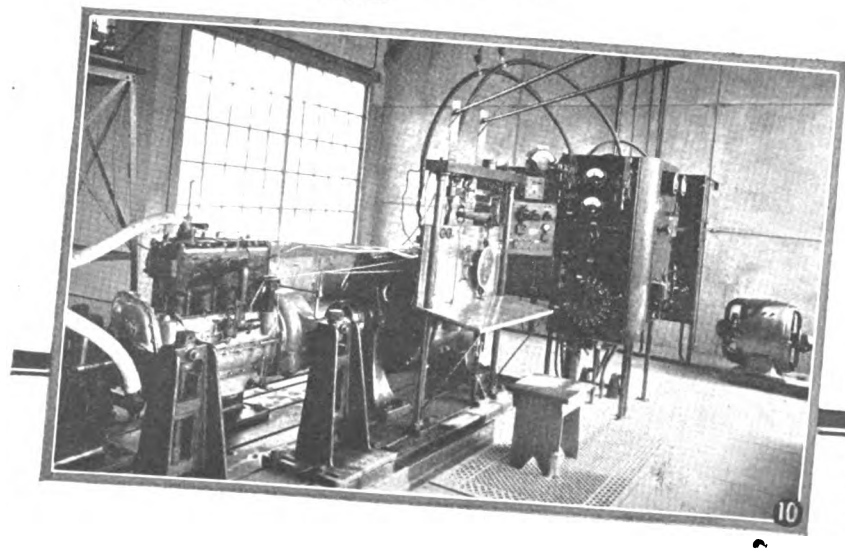


Fig. 10. Motor testing laboratory at Avon. Very exacting tests are made of both lubricants and petroleum fuels under actual operating conditions.



Fig. 11. An oil gauger with his "thief," used to take samples from a storage tank. With the tremendous increase in storage, the gauger's job has become one of the most important in the oil fields.

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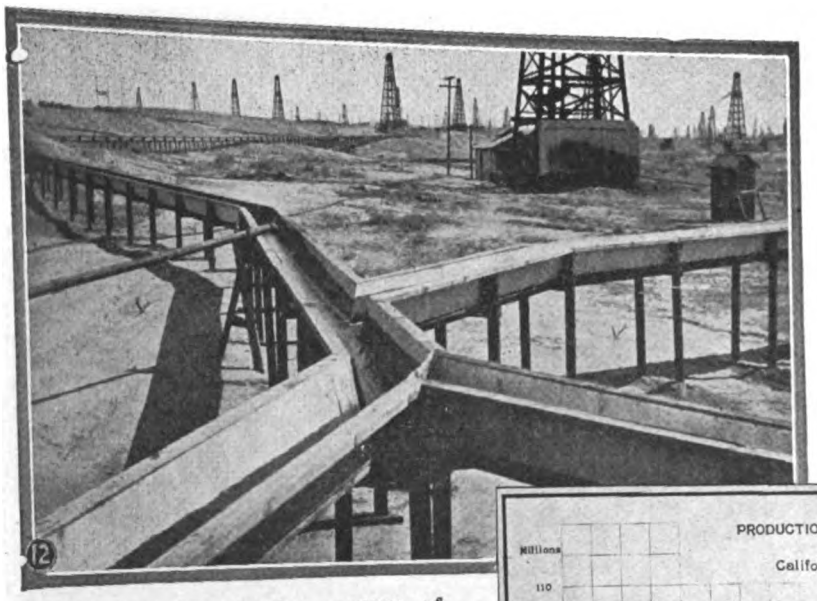


Fig. 12. A collection system of flumes used for wells pumping heavy oil and sand. Troughs are of sheet metal.

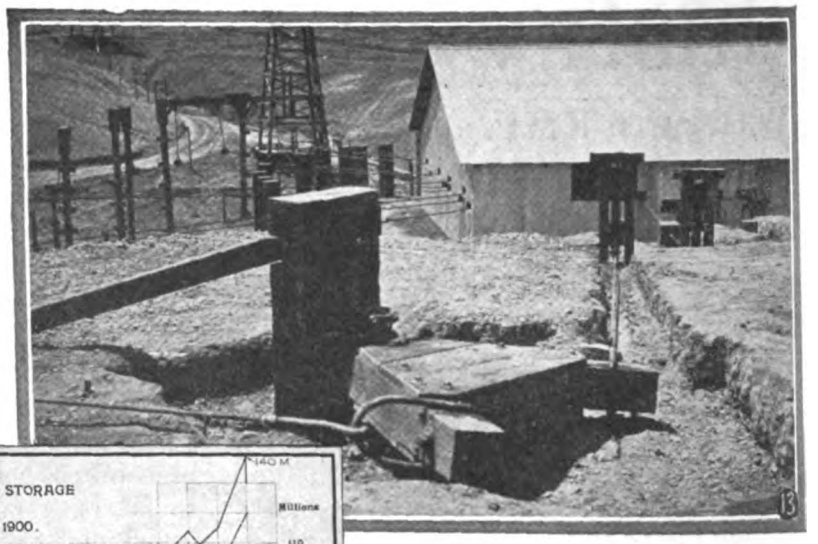


Fig. 13. A right-angle turn in a jack plant pumping cable.

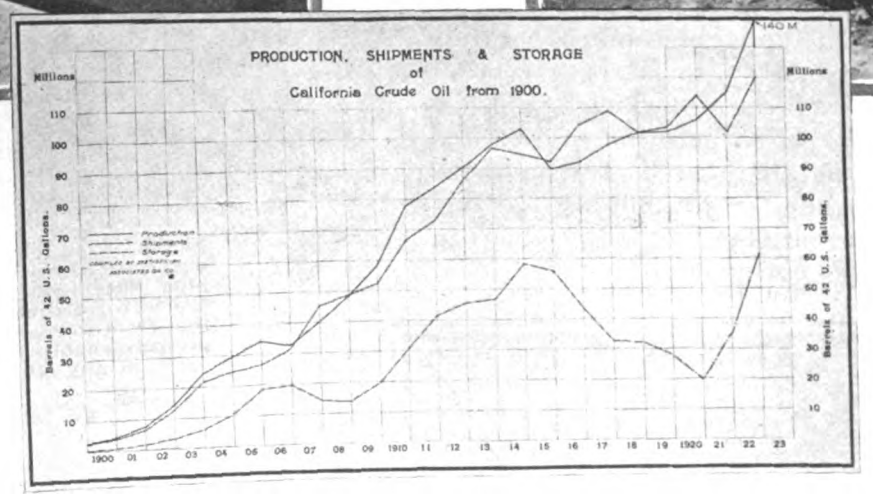


Chart of production, shipments and storage since 1900.

Although the adoption of such a type of organization required the investment of extremely large amounts of capital, and involved managing scores of small divisions of employees widely scattered over hundreds of miles of territory, it very greatly reduced the attendant risks of operation. While it is true that the owner of oil land has frequently been made wealthy by the discovery of oil, the corporation engaged only in drilling and oil production, can not in every case be said to have been equally fortunate. Where one man has amassed wealth through his organizing and executive genius, a score of others have lost everything in the oil gamble. Even in the tremendously rich Southern California fields, this has been more or less true. Numerous farmers and owners of town lots have sold their land for exorbitant prices, or have drawn large royalties from flush production, thus enabling them to buy high-powered motor cars and visit all the home folks in the eastern states. A few operators have done equally well, but not all have been so successful by any means.

Some of the problems of the early days in California's petroleum history may be typified by the events which succeeded the discovery of oil in the Kern River field, near Bakersfield, in 1899. The discovery well was drilled by a woodchopper named J. M. Elwood, who sunk a shallow shaft to a depth of seventy-five feet in the river bank. In a short time, the rush for oil lands resulted in drilling rigs being thickly scattered over a territory nearly five miles square. Many wells yielding as much as 500 barrels per day were soon completed.

In 1901, the annual oil production of California approximated 9,000,000 barrels. The wells drilled along the Kern River were capable of producing nearly twice that amount. The entire territory was owned by hundreds of small companies and by many private individuals, among whom there was no unity of action or purpose. Pipe lines were not available; the railroads had no equipment to handle that oil; and markets were still undeveloped. The price fell from about one dollar a barrel to figures which threatened the stability of the entire industry. Large contracts were made at twenty cents a barrel, and spot oil could be had for ten or fifteen cents.

Through the efforts of a small group of engineers and business men, a corporation was formed in October, 1901, known as the Associated Oil Company. In three or four years' time, nearly forty of the Kern River companies entered

(*Continued on page 65*)

Fig. 14. Water helps to float the oil to central tanks for separation from water and sand.

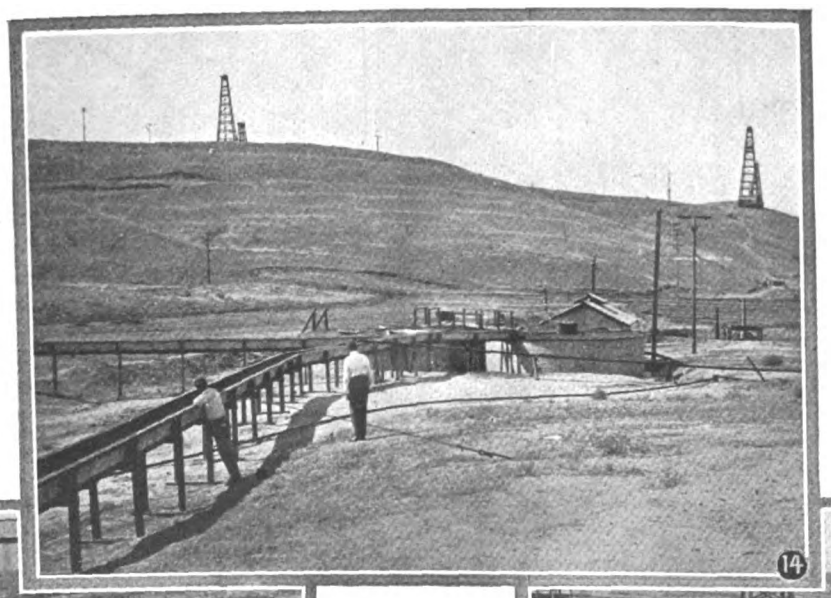
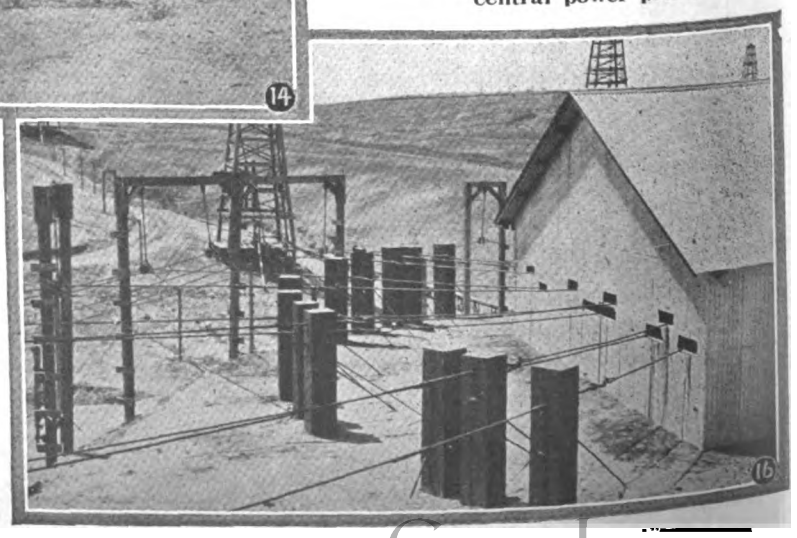


Fig. 15. Well pumping into collection troughs.



Fig. 16. A jack plant pumping several wells with one central power plant.



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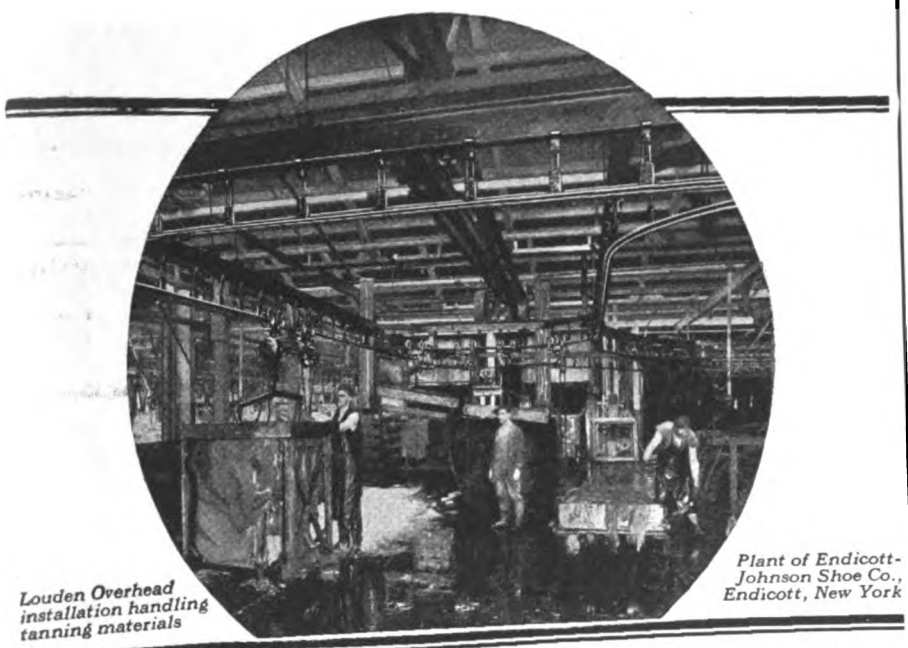
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Making the Equipment Fit the Job

(*Continued from Page 12*)

er importance to the smaller plant.

Figure 10 shows a tiering truck holding heavy castings for the drilling operation. Those who are familiar with such operations as this will recognize the desirability of eliminating as much of the heavy manual labor as possible. If the machine attendants are relieved of a large part of the laborious lifting and handling, closer attention to the important details of the operation will be shown, and there will be less dissatisfaction and labor trouble. Satisfied workmen means decreased labor turnover, and reduction in rejected and scrapped products. The savings from this source alone frequently justifies the introduction of this equipment.

In the case of large machine shops, however, tiering trucks will perform more than this one operation. They have been found particularly adapted for changing dies in punch presses and drop forges. A large manufacturer in investigating the changing of dies in drop forge rooms, found that it required from two to five hours to change each die, and that under ordinary conditions, the operation usually required from three to four men. It was found that the annual cost, figured on this basis of changing one die per day, is as follows:

Four men for 3½ hours, at 50c per hour makes a total of $7 per day. Assuming a production value of $30 per hour for the drop forge, 3½ hours for changing dies meant a total loss of $105 per day, and when including the men's wages, the total loss was $112 per day. Figuring 300 working days, this made an annual cost of $33,600 for changing dies.

By installing proper racks for storage and a tiering truck, it is now possible to pick up, deliver and place any die weighing up to 4,000 pounds, in ten minutes. The cost of changing dies, with a tiering truck, allowing for production time, is approximately $5 per day, and figuring on 300 working days, the total cost is $1,500, making a saving of $32,100 per year over old hand methods.

Other operations upon which the tiering truck can be used are shown in figures 9, 10, 15 and 17, and in each case the saving was generally large enough to quickly pay for the truck, and show a profit during the first year's operation.

Loading motor trucks, where there is no loading platform, has always been a difficult proposition, but as shown in figure 14, it can now be simplified, not only making a saving in labor expense, but also a saving in idle motor truck time, waiting for loading and unloading. The piling of materials or placing them in bins,



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usually requires lifting and climbing. The trucks shown in figure 17 are an exceptionally high lift of tiering truck, the over-all lift from the floor to the bed of the platform in the maximum elevated position being eight feet. They have been found particularly efficient in this large stockroom, where thousands of packages are handled each day.

Figure 9 shows a tiering truck tiering bags on steamship docks, raising the loads 70 inches from the ground. This truck also transports the load from ship side to pile. When using tiering trucks as transporting units and for general hauling, care must be taken to see that the uprights are low enough to clear all doorways, and the operators should be instructed not to make long hauls with the load more than eight inches or ten inches from the floor. The method of operation is similar to that of ordinary elevating lift trucks with platforms and skids.

The advantage of lifting materials to given heights has caused a number of adaptations or attachments to be applied to the tiering truck principle. Figure 8 shows a special short wheel-base truck, with a special platform or attachment, which has proven very advantageous in chemical plants. The arms are arranged to handle cylindrical or square packages. When changing from one to the other, it is only necessary for the operator to raise one set of fingers, and the other set automatically comes down in position. This is accomplished by the use of a quadrant set of gears as shown. The load can then be raised to the height of the uprights for charging vats, kettles, etc.

The use of arms and fingers on special trucks shows the tendency for mechanical equipment to imitate the human being, and the reason for this is that the human system is so constructed that it is adapted to handle practically everything. It is not surprising therefore, to see so many different types of finger trucks on the market. One of the newest models is the development shown in figure 16. It embodies the particular feature of being able to pick up its load without the use of platform skids, and in addition, allows for the stacking of units without the usual waste space of 12 to 14 inches which is incident to the tiering of loads on platform skids.

A truck of this design is now being used for handling sheet tin, and is performing an operation which would otherwise have been carried on with old hand methods, as the use of platform skids for carrying the load into the freight car called for so large a quantity that the investment charged wiped out the considerable savings otherwise effected. The loads are now placed on 2″ x 2″ strips, thus eliminating the skid investment. The tin is placed on these strips in the car at the mill, and a similar truck unloads the tin at the plant, and stacks it in 2,000-pound units, three high. An operator and a helper can unload a 30 to 40-ton car in about an hour and a quarter.

The application of this unit to other commodities is possible, with the attendant saving of the investment in skids.

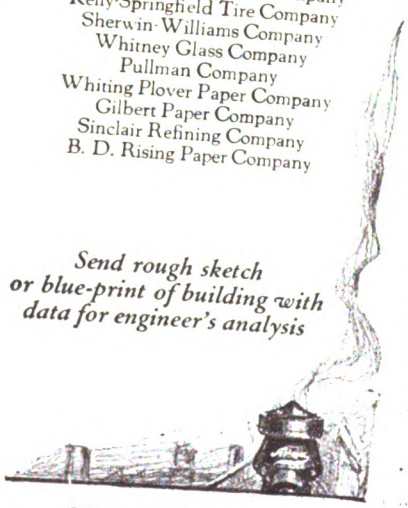




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..... Street Address ..... City ..... State

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This is only one of the many small attachments that can be placed on standard equipment to make the equipment fit the job. There is practically no industry in which some type of special truck cannot be used, and the manufacturers are willing to assist in making the equipment fit the operation. Frequently this special equipment which is designed for some particular problem becomes so universal in use that it is shortly considered as standard. Such is the case with the dump body trucks, as shown in figures 1, 21 and 22. This equipment is gasoline driven, and can also be used as a tractor.

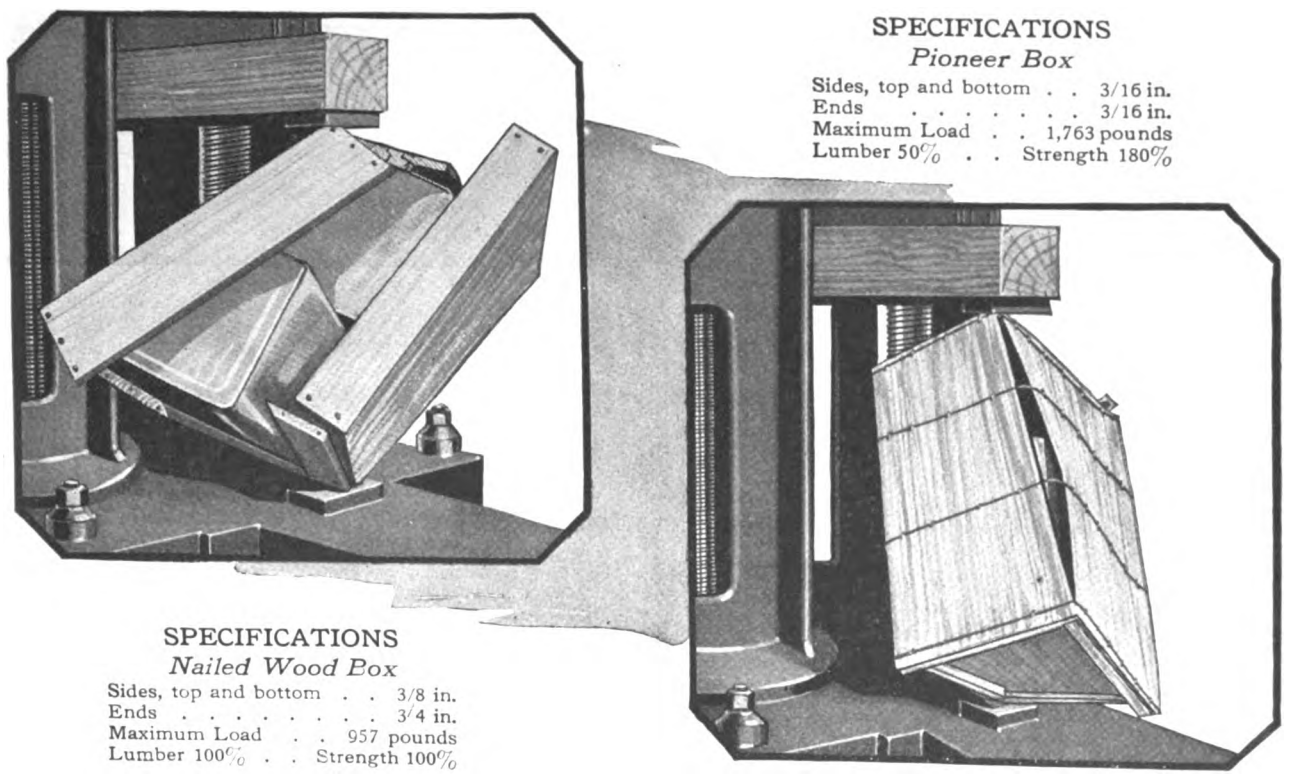
Figure 1 shows how the Arcade Malleable Iron Company, Worcester, Mass., by installing a hand hoist dump body truck, replaced 8 wheelbarrow men in the hauling of coal from storage pile to power house. There are many places where it is impossible to install conveyors, but the use of a dump body truck will make a saving and better operating conditions in the handling of bulk materials. An illustration of this is in the handling of coal in brick yards, etc., as shown in figures 21-22. These photographs were taken in the Globe Brick Company's plant at East Liverpool, Ohio, and show the method of handling coal from the track hopper to the kiln. A second truck is also used for handling cinders, bats, and other refuse to the dump. The placing of a large gate handle, where it can easily be reached by the driver of the truck as shown in figure 21, makes it possible for a man to do his own loading, and as the truck is automatically dumped, there is no need for assistance when unloading it. This company now employs two men—one for each truck, and they handle all the material. In coaling, the average monthly tonnage handled, is approximately 2,000 tons. For the above tonnage, and for handling cinders and refuse, their expense for a 30-day month, for men, mules, carts, etc., averaged $930. With the two dump body truck tractors, the expense for a 30-day month averaged $403.10. This represents a saving of $526.90 per month, over the old methods. They figured that the equipment paid for itself in the first 8 months, and that they are now making additional savings.

The saving of man hours, or, in other words, money, was the first reason for installing materials handling equipment, but now consideration is being given to operating conditions, and to the laboring man. At one time there was no more disliked job than the placing and removing of pots in annealing furnaces. These pots were very heavy in some instances, and considerable time was lost in allowing them to cool, so as to make it possible for men to handle them. Now, an electric truck called a furnace charger does this work quickly with less effort to the men and at less expense, and handles the pots when they are still red-hot, frequently operating in a temperature as high as 750° Fl.

Figure 6 shows such a device, and in the plants where this type of equipment is being used, they are dubbed by some the "foundry alligator" and by others the "big cockroach"

(Continued on page 32)

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—and John Bright

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IN hundreds of plants where I have successfully solved practically every kind of cleaning problem, I have surprised the executives not only because the proper INTERNATIONAL cleaner was able to do the job better, but also because I have saved them considerable time and money.

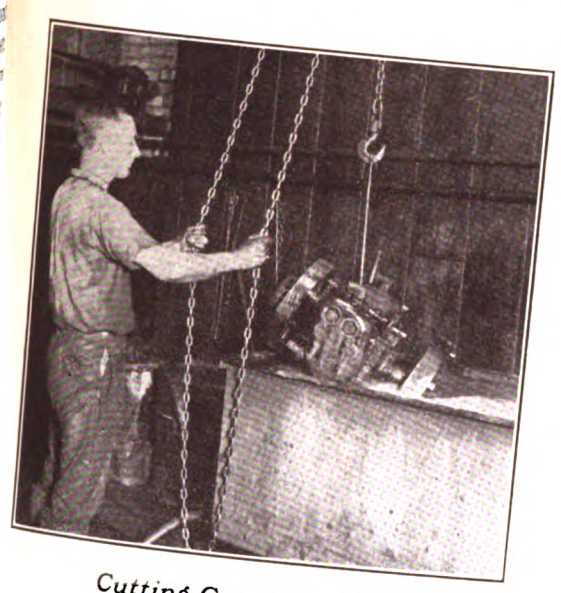
Of course there is a reason for this. Each INTERNATIONAL CLEANER was placed on the market only after it had been tried and tested out under a number of actual operating conditions. Therefore, all experimentation has already been done for you. We are past the guessing stage.

To improve cleaning conditions and save money, all you have to do is to let me know the details of your operation and I'll come on the job with the INTERNATIONAL CLEANER which we have found will meet your individual needs.

I'm so sure of my claims that I'll ship a trial lot of cleaner with the understanding that you do not have to pay a cent for it unless it improves results and cuts your costs.

Give me a chance to show you what I can do. Fill in the following technical report and I'll do the rest.

Internationally yours
John Bright



Cutting Grease and Oil



Cleaning Machine Parts

Technical Report to
International Chemical Co.
Philadelphia, Pa.

I want to clean the following .....
Subsequent operation .....
Materials on the work .....
Please send me a trial lot of the proper cleaner together with full directions covering its use. Send me complete information .....
Name ..... Address .....

International Products
IC
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INTERNATIONAL CHEMICAL CO.
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(*Continued from page 30*)

because of their shape, and the speed with which they dart about the plant. This machine is employed principally in handling six to eight thousand pound pots of castings in and out of the annealing furnaces. It will be noted that the truck, figure 29, is equipped with herringbone steel wheels at the front end of the truck, while the one in figure 30 is equipped with rubber-tired wheels. This is purely a matter of preference, as the rubber tires stand up quite satisfactorily under the high temperatures, although the maintenance is slightly greater than if they were not subject to this heat. The equipment is very well protected from the dust and heat usually found in places where it is necessary for them to operate.

In one large plant, four of these furnace chargers pick up, haul and place 25,000 tons of foundry material every 24 hours. It has been found that 100 tons of finished castings require four tons of pots and packing, and that each stack of pots requires five handlings. This tonnage is equivalent to that transported by a freight train of fifty 50-ton cars, and yet the total cost for electric power to perform this enormous task is just $4.00 per day.

To make another comparison, or express the above in other words, it has been found by observation that two operators, with two furnace charging trucks, can move 900 stacks of pots, weighing 3,000 pounds each; 480 stacks were transferred 300 feet, and 420 stacks were delivered a distance of 80 feet, in just five hours, and 15 minutes. Compare this with any other method of handling pots and remember practically no change in present foundry layout was required when installing this equipment.

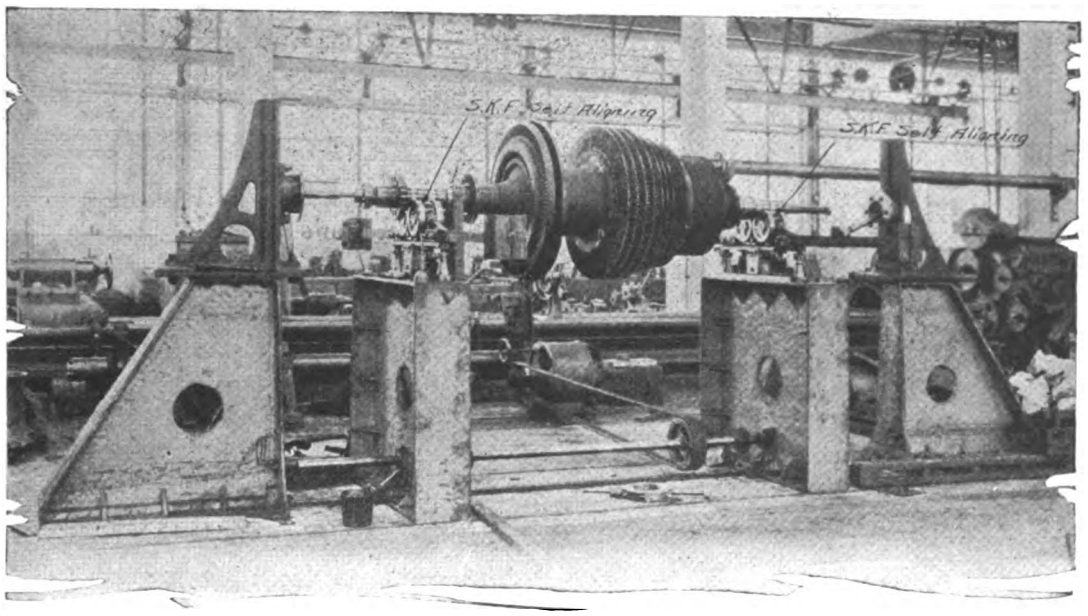
These trucks are not restricted to work at a given spot, but may be driven anywhere. The operation of the furnace charging truck is very simple. The front end is equipped with a pair of fingers which slip under the load and then the operator starts the motor, which tilts the load so as to carry it in a slightly inclined position. When unloading, the operator runs the truck to the point where he desires to place the load, and then starts the motor again, which permits the load to come into an upright position, and by backing the truck withdraws the fingers from under the load, and proceeds to the next pot.

The furnace charger truck shown in figure 30 is handling skid loads of raw materials about the yard. While special skids are required due to the height of the lifting mechanism, there is no reason other than the unwieldiness of the equipment, why it should not be used on this operation, when it is not kept busy handling pots at the annealing furnaces.

There are many unwieldy packages which are odd in shape and difficult to handle, but special trucks, such as those shown in figures 4, 5, 7, 23 and 24 are now handling this class of material with ease.

Figures 2 and 3 show the method of handling automobiles packed for export before the special trucks shown in figures 4 and 5 were installed.

SKF



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On 150,000-lb. Dynamic Balancing Machine

UNLESS massive, high-speed machinery is in dynamic balance serious vibration occurs and causes quick destruction of the machine elements.

In order to make accurate corrections for lack of dynamic balance, it is essential that the testing machines themselves contain no parts which produce vibrations. Of these parts, the bearings are most important for motion tends to cause wear which in turn means vibration.

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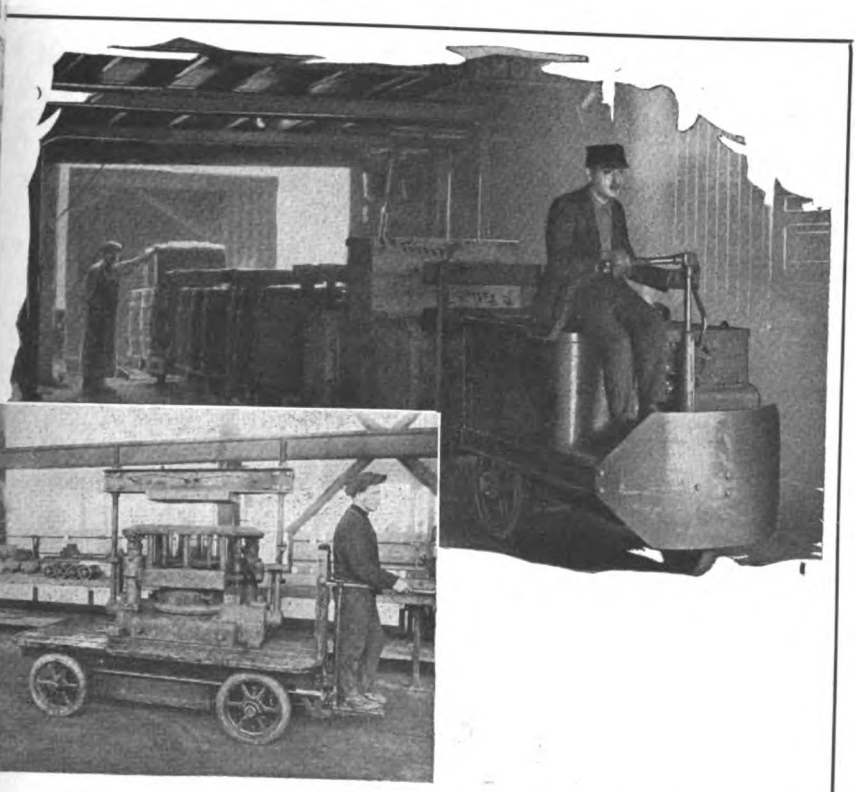
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Let us help you solve your industrial haulage problem. Our engineers can show you many ways to save money and time. Their advice entails no obligation on your part.

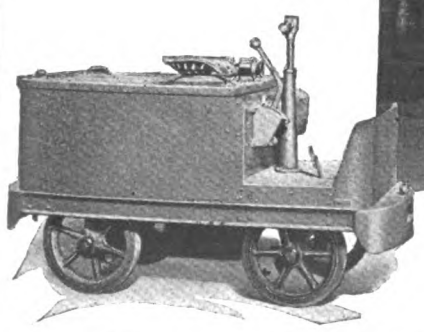
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CRESCENT
ELECTRIC TRUCKS & TRACTORS

It will be noted that it required 9 pier laborers to load these packages on hand trucks, and it required 8 men to move them along the pier. Now the entire operation is handled by two men and two trucks, quicker and cheaper. These trucks are standard pieces of equipment fitted with the attachment which is shown at the front of the truck. The two illustrations show the method of operation. The trucker runs the fingers under the load, and then elevates them, raising the load off the floor for transportation. In the case of smaller packages, the fingers on one truck are run under the load, and a chain is thrown over the package to hold it in position, the operation after this being the same as in the case of larger packages, namely, elevating the fingers, which raises the load off the floor.

The equipment shown in figures 23 and 24 is a standard electric storage battery truck, fitted with a special carrying frame, which is capable of handling rolls of paper, boxes, and other loads of similar size and weight. A flexible band holds the load in position, and because of its flexibility, it will grip any shape package. Both these loads are bulky and difficult to handle, and would require several men if performed with common hand methods. These illustrations should quickly point out the advantage of handling unwieldy packages and transporting them by mechanical, instead of man power.

Crane trucks are built in many different designs. Some of these trucks are equipped with short booms, others with long booms, and some are even equipped with sectional booms and outriggers, so as to permit the lifting of loads over a large radius. Some of the trucks carry the load suspended from the hook, figure 9, while others are mounted on trucks, which permit the load to be carried on the truck platform, figure 20. In this case the crane is only used for loading and unloading. Some of the crane trucks have the crane boom and battery box mounted on a pivot as a single unit; with this construction it is possible to swing the boom in a complete circle, figures 18, 19.

The crane truck has been particularly successful in ma-



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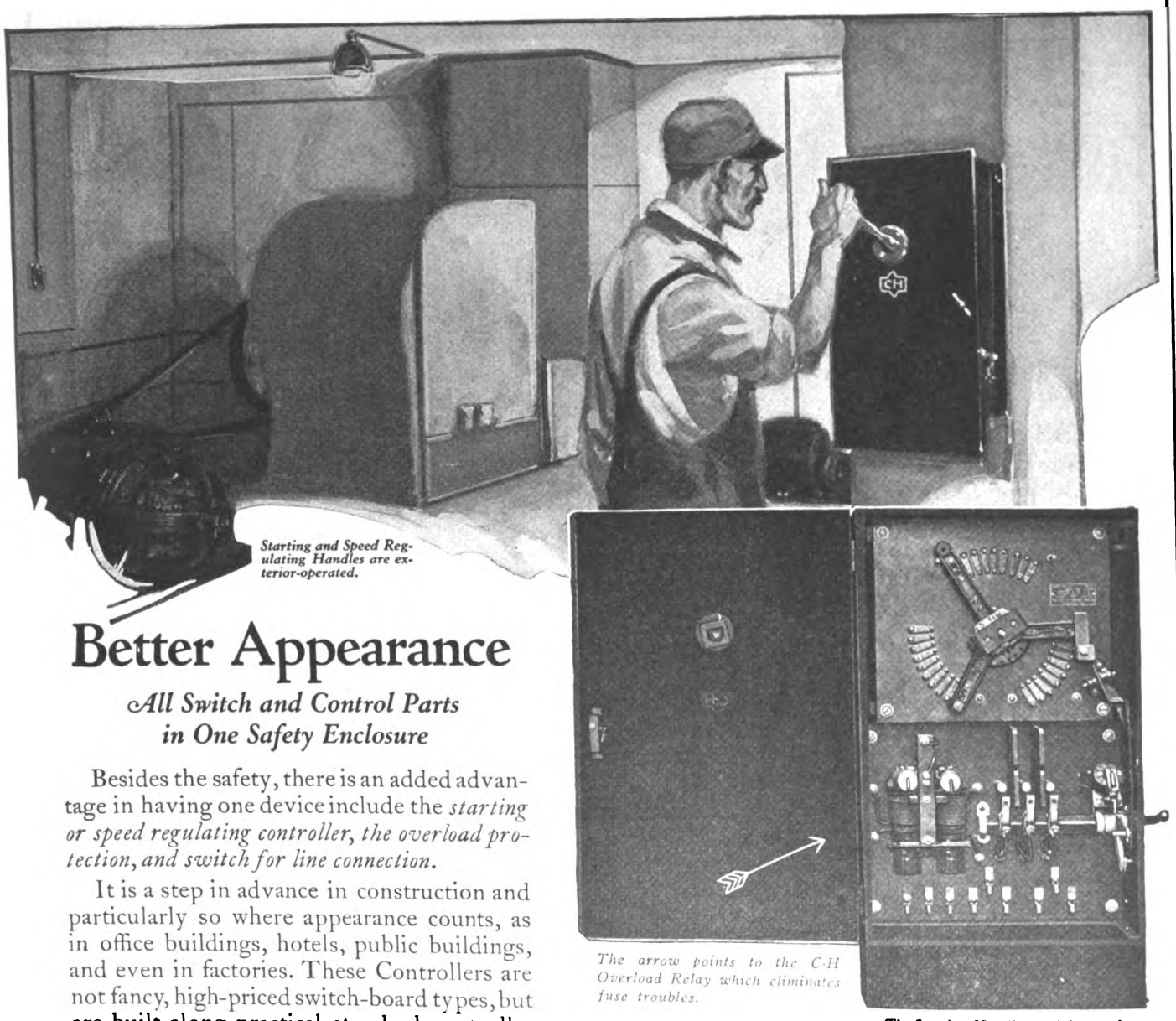
chine shops, locomotive works, foundries, and in operations where cumbersome packages have to be raised and lowered, as well as transported. It is very simple, frequently, to pick packages up in some form of sling, where it would be impossible to handle them in any other manner.

There has always been a great deal of expensive labor and much danger attendant to the handling of newspaper rolls, which run anywhere from 1,500 to 2,000 pounds each, these rolls averaging in length from 32 to 72 inches. In the average plant, the up-ending of a 72-inch roll is a task which follows the placing of the wrapper around the roll as soon as it leaves the machine. This usually requires one man standing at the end with a stick thrust into the core hole, and two others lifting with him half the weight of the roll, in order to up-end it on to a cardboard end paster. After this operation, these rolls must again be laid down before being transported into a car. They are usually rolled or handled on some form of hand truck. The truck shown in figure 25 will pick up a roll from a horizontal position, carry it on the truck, stand it on end, or lay it down as desired, or it will pick up a roll from a standing position, figure 26, and deliver it, setting it up on end, or laying it down, as required.

The entire cycle of operation is accomplished by means of a very ingenious device all of which is actuated by a single cable from a single drum hoist, located in front of the battery box. This is a very simple method, when considering the great number of functions the unit performs. When it is desired to stack two or three small rolls, one on the other, end to end, it is only necessary for the apron of the truck to be thrust beneath three of these rolls in a row, whereupon it will immediately revolve them into a vertical position, standing them up.

Another make of truck to perform the same operation, is shown in figure 27 and 28. Several of these trucks are in use at the plants of one of the large paper mills in the United States, where they have saved thousands of dollars annually. before installing the trucks, the large 72-inch paper rolls were handled on a 24-hour a day basis, by seven men per shift, these men operating for finishing, up-ending and trucking, five men being actually used for up-ending the rolls. With the use of this truck two men are now used per shift, for up-ending and trucking to the shipping department. Both men are finishers, one finishing and driving the truck, the other finishing and heading the roll.

Here, then, an initial saving of five men per shift has been effected. In dollars and cents, this means a saving on a 300-day basis, of over $21,000 per year. There is also a material saving in time of handling the roll, and the greatest saving by far is in transportation, to say nothing of taking the heavy manual labor off the men. The truck can be used for either lifting the roll from a horizontal position or from a vertical position. The illustration herewith shows a truck handling a large roll in a horizontal position. One of the distinct features of the truck is that when the lifting arms



Starting and Speed Regulating Handles are exterior-operated.

The arrow points to the C-H Overload Relay which eliminates fuse troubles.

The Starting Handle at right can be locked open to prevent unauthorized persons from meddling. The case can be locked also.

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C-H *Overload Relay* *Saves Fuse Troubles and Expense*

The delayed action of the C-H Overload prevents unnecessary interruption on temporary overloads but provides full protection against injury to motor. The time required and the expense of renewing fuses is entirely eliminated.

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C-H CUTLER-HAMMER **ENCLOSED CONTROLLERS**

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come together on the roll with sufficient pressure to lift it, and note here that this is not a crushing pressure, the lifting mechanism automatically elevates the roll. The adjustment of the truck is so regulated that it can be manoeuvered up to a roll so as to eliminate any possibility of breaking the edge of the roll while lifting.

Many warnings have been sounded regarding the shortage in the common labor market, but there are still some executives who have not fully realized the seriousness of the situation. Other executives have, however, felt the need of supplementing man power with mechanical equipment, but quite frequently the handling of certain classes of materials mechanically is considered impossible, because the executives are not familiar with the different types of special equipment that have been developed, and they are reluctant to spend the money to design and develop special equipment to fit their needs. A number of materials handling representatives overlook, or do not know of the many ingenious devices that have been added to standard equipment, or do not push the special designed equipment which is now successfully performing mechanical operations that have always been considered as necessary evils, to be performed by hand labor.

There is also a tendency on the part of some executives to feel that a truck that has been designed particularly for the foundry industry, or for the chemical industry, cannot be used in the textile industry or paper-making industry. This attitude is costing industrialists thousands of dollars each year. Frequently by merely making a slight change in some part of equipment that has already been designed for a particular job, it is possible to adapt this same equipment to several other operations. The executive should not consider that because a truck is called a tiering truck, that it can only be used for piling materials, but he should look at this equipment, and see if it is possible to slightly alter it and use it in many places throughout the plant.

The secret of successful operation of any mechanical equipment is to keep it constantly busy, and because of this it is necessary to provide each piece of equipment with all the accessories or attachments that can be used on various operations throughout the plant. For instance, a tiering truck can be equipped with a roller platform, as previously mentioned, for handling dies, but as this operation will not require the full use of this truck, it could at the same time be provided with a dump body skid, or a series of dump body skids for handling refuse.

In addition, the same truck could be used for transporting and tiering materials in the warehouse.

A crane truck should be provided with all types of slings for handling all classes of materials, and when purchasing the truck, the boom should be given every consideration, so that it will fit into a number of operations through the plant.

In the case of the furnace charging truck, it is best to keep it active on the particular work for which it is designed.

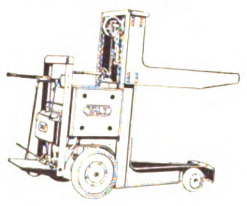
(Continued on page 37)

YALE—the key to lower handling costs
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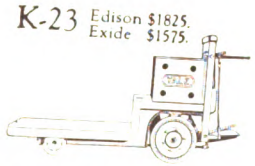


K-20 Edison $1825. Exide $1575.

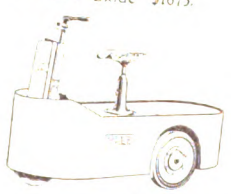
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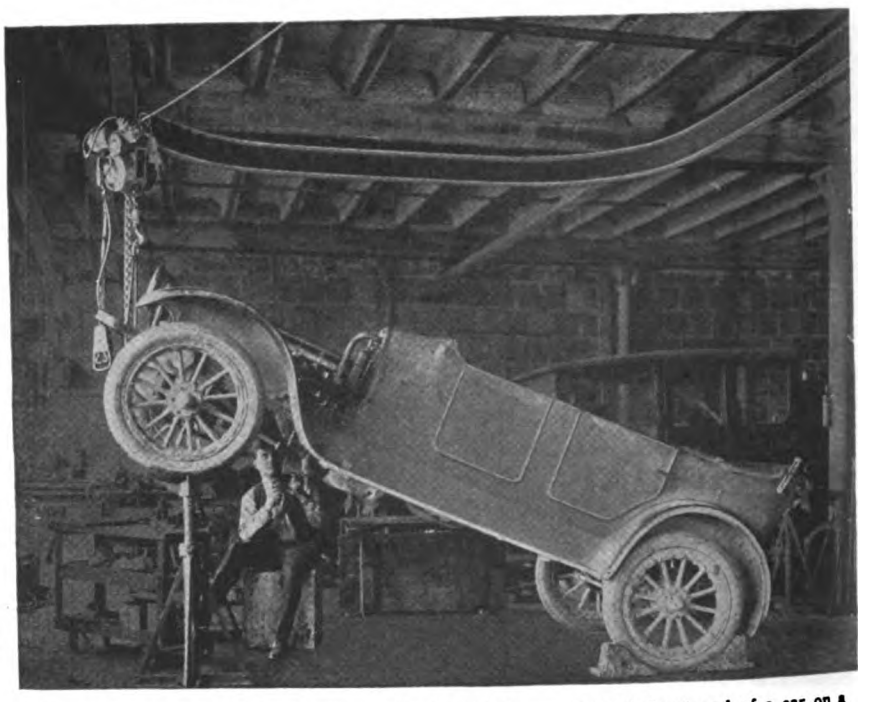
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They hold the water at a fixed level in the boiler under all operating conditions and at all boiler loads.

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Clarage Fans are built in types and sizes for every service.

(*Continued from page 35*)

Some plants who do not have enough of this special work have found it profitable to use special designed skids for handling raw materials in the yard. In this case the furnace charging truck is used the same as the lift truck, but it is rather unwieldy to handle on such work, due to its excessive length.

The paper truck is so special that it is doubtful if it could be used for handling any other class of material, but by making slight changes in the design of the carrying end, there is no reason why the same principle could not be used for handling materials in other industries.

The plant executive who is anxious to reduce his production costs should keep in constant touch with the new equipment that is being developed in the materials handling field. This applies not only to trucks, but to conveyors, elevators, hoists, monorails, cranes, etc., because there are many new developments being brought forward each year.

The laboring man of today is not so anxious to exhibit a large amount of bull strength as was the case ten years ago, and frequently because the work is heavy, they have a tendency to idle on the job. It is a well known fact that as people become educated, they think less of doing manual work, but there is no need to waste this education, or to restrict it, and for this reason the laboring man should be supplemented with as much mechanical equipment as possible, so as to remove the drudgery from his work, and at the same time permit the executive and the industry to realize a profitable return on the investment.

The installations described in this article show only a few of those which are now operating, and in each instance, the money savings are enormous, but as previously pointed out, it is not only the saving of money and a conservation of labor that is causing the installation of mechanical equipment, but it is the tendency of the progressive executive to make better working conditions in return for which he reduces labor turnover and labor trouble.

There is no doubt but what

(*Continued on page 39*)

ELWELL-PARKER



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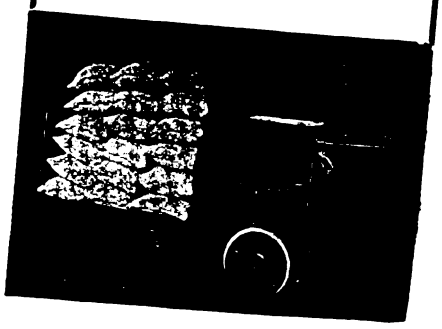
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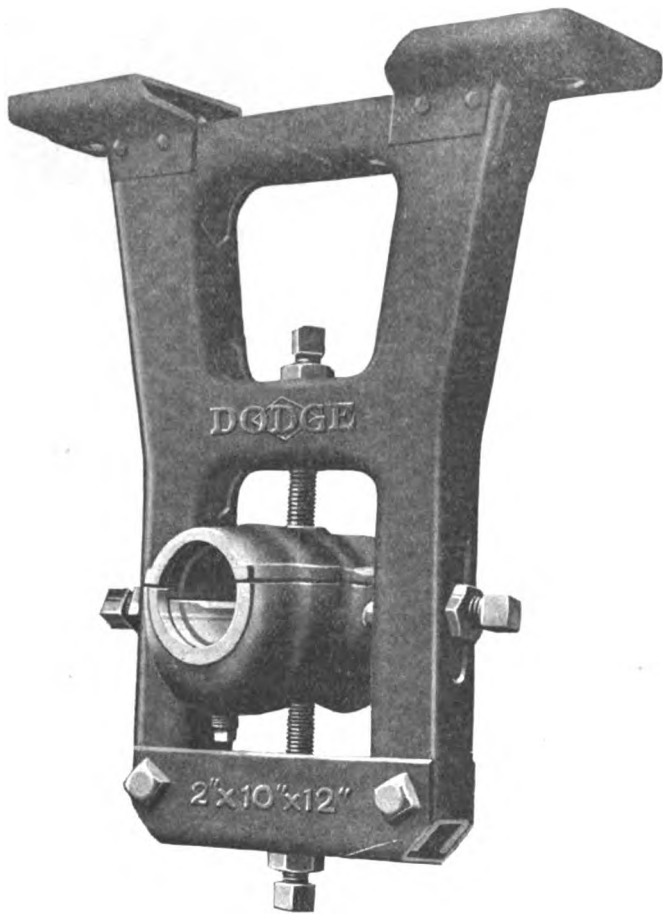
Our unobligating survey is yours on request, or ask for Bulletin 51.

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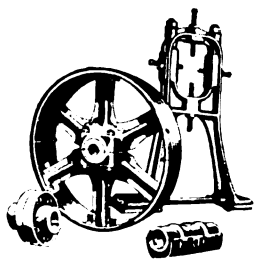
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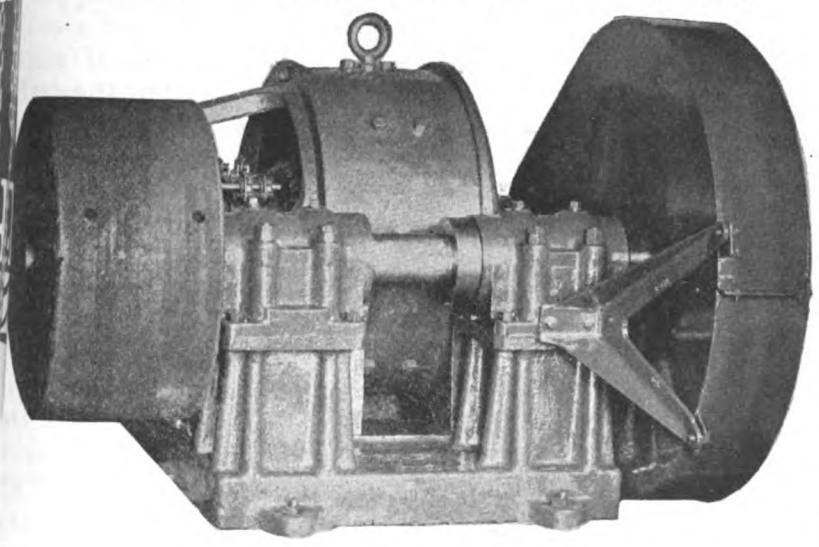
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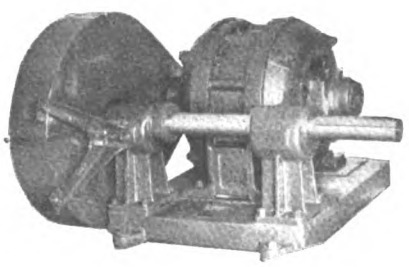


170 rpm on this pulley without the use of countershafts or special slow speed motors.

The above unit drives a clay mixer in the new plant of the Columbia Steel Co., Springville, Utah. It comprises a Reliance Heavy Duty, type T, 30 HP, 850 rpm Direct Current Motor equipped with a standard W-F Reduction Gear Drive. Gear ratio of 5 to 1 through silent pinion gives a Back Shaft Speed of 170 rpm.

This equipment is subject to extremely heavy starting conditions and continuous severe service so commonly met with in steel mills, under which only the most rugged equipment stands up.

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ENGINEERING COMPANY

PATERSON, N. J.

(Continued from page 37)

this country will always be more or less faced with a labor shortage, particularly in the field of common labor, and it is therefore a necessity for the progressive executive to become thoroughly familiar and conversant with all forms of materials handling equipment. There are a great many machines nowadays which are considered standard, and which have been so highly developed that it would be difficult to perfect them further, but there are a number of operations that these standard machines cannot perform. Frequently by slightly altering the nature of the work, the standard equipment will handle it, but in other cases, to change the nature of the work is impossible, either due to precedent or to plant construction and operating conditions. The field of materials handling equipment has now become so large that it is not necessary to make the job fit the equipment, because the equipment can easily be designed to fit the job.

While the most optimistic expectations regarding the stimulus which the fall trade would impart to general business have not been met in September, some quickening of activity has appeared. The reductions in forward buying during the summer months contributed to the maintenance of generally conservative inventories and have necessitated new buying for the replenishment of stocks. A continuation of moderately good business in the immediate future is indicated.

The recession in average commodity prices has been arrested, and in August and the early weeks of September advances were recorded.

There have been only moderate seasonal advances in money rates, and the credit resources of the banks are ample to meet all the requirements of fall business without strain.

The resistance of business and finance to a succession of untoward circumstances, such as the threatening aspects of the controversies between Italy and her Balkan neighbors, and the disastrous earthquake in Japan, further attests the fundamental strength of the domestic situation.

(The Guaranty Survey)

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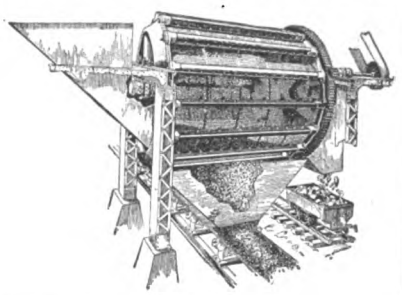


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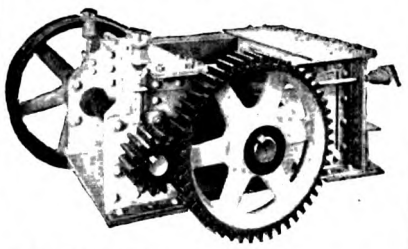
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Why the Superheater?

(*Continued from page 17*)

form of a gas. As soon as it has been partially condensed its usefulness for developing mechanical or electrical power has been proportionately reduced. Naturally the ideal condition occurs when the steam leaving the engines or turbines has given up sufficient heat in the production of work so that it is just at the point of condensing.

If the steam generated by the boiler is dry saturated, however, this ideal condition cannot be realized, owing to the condensation losses just described. It is obvious, therefore, that to approach the ideal, to eliminate line and cylinder losses and to get the maximum work possible out of a given weight of steam, sufficient heat must be added after it leaves the boiler, in order to counteract these tendencies to condense and to preserve its full energy for the development of useful horsepower.

The addition of heat to "dry saturated" steam raises its temperature in just the same way that the temperature of air is raised in a hot air furnace. The amount of superheat is designated by the difference between the actual steam temperature and the temperature that steam at the same pressure would have if it were dry saturated.

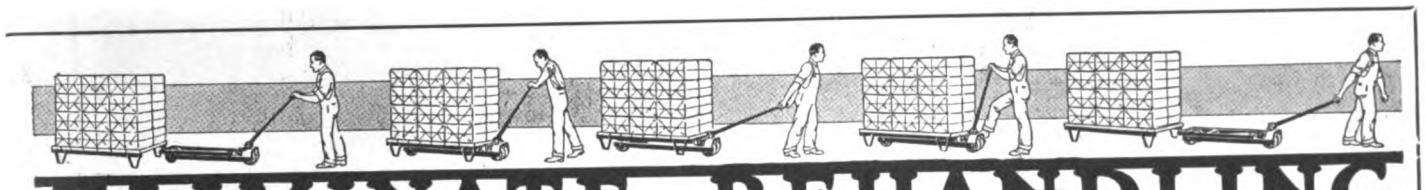
For example, the temperature of dry steam at atmospheric pressure is 212 deg. F. The temperature of such steam may be raised to say 312 deg. F. by merely heating it, although the pressure would still remain the same. It would then have 100 degrees of superheat.

It must be understood that steam cannot be superheated in the presence of water, since the added heat in the steam would immediately evaporate sufficient water to saturate it again. In doing this it would give up its surplus or "super" heat to the water which it evaporated and suffer a consequent reduction in temperature to where it was before.

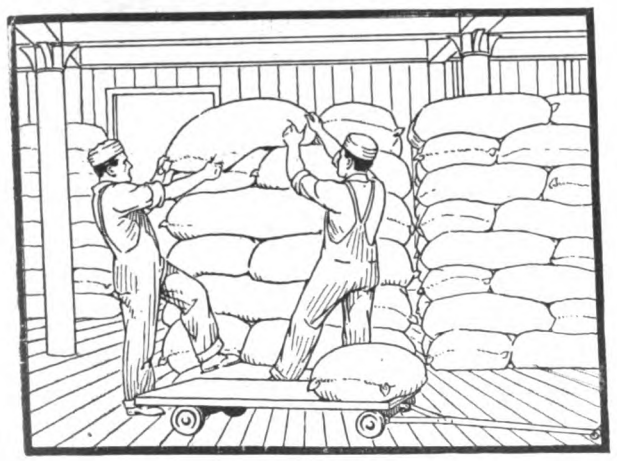
In order to superheat steam and eliminate condensation losses, therefore, it is necessary to pass the generated steam through a heating device which is separate from the boiler proper. Such a device is a superheater. It consists of a series of tubes similar to the boiler tubes themselves, through which the steam from the boiler is passed. Usually the superheater is placed within the boiler setting, so that the gases of combustion, as they pass over the boiler tubes, heat the tubes of the superheater as well. In some cases superheaters are installed in a separate setting and are separately fired.

Although the possibilities and economies of superheated steam were known more than a century ago, the development of its use for power purposes was necessarily delayed, largely due to the fact that the attention of engineers was for the most part directed toward the perfection of prime movers, rather than the more economi-

(*Continued on page 42*)



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Two Men
5 Minutes



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BY eliminating rehandling of goods and materials, as illustrated to the right, the Cowan Hand Lift Truck and Skid System is everywhere effecting large time and labor economies.

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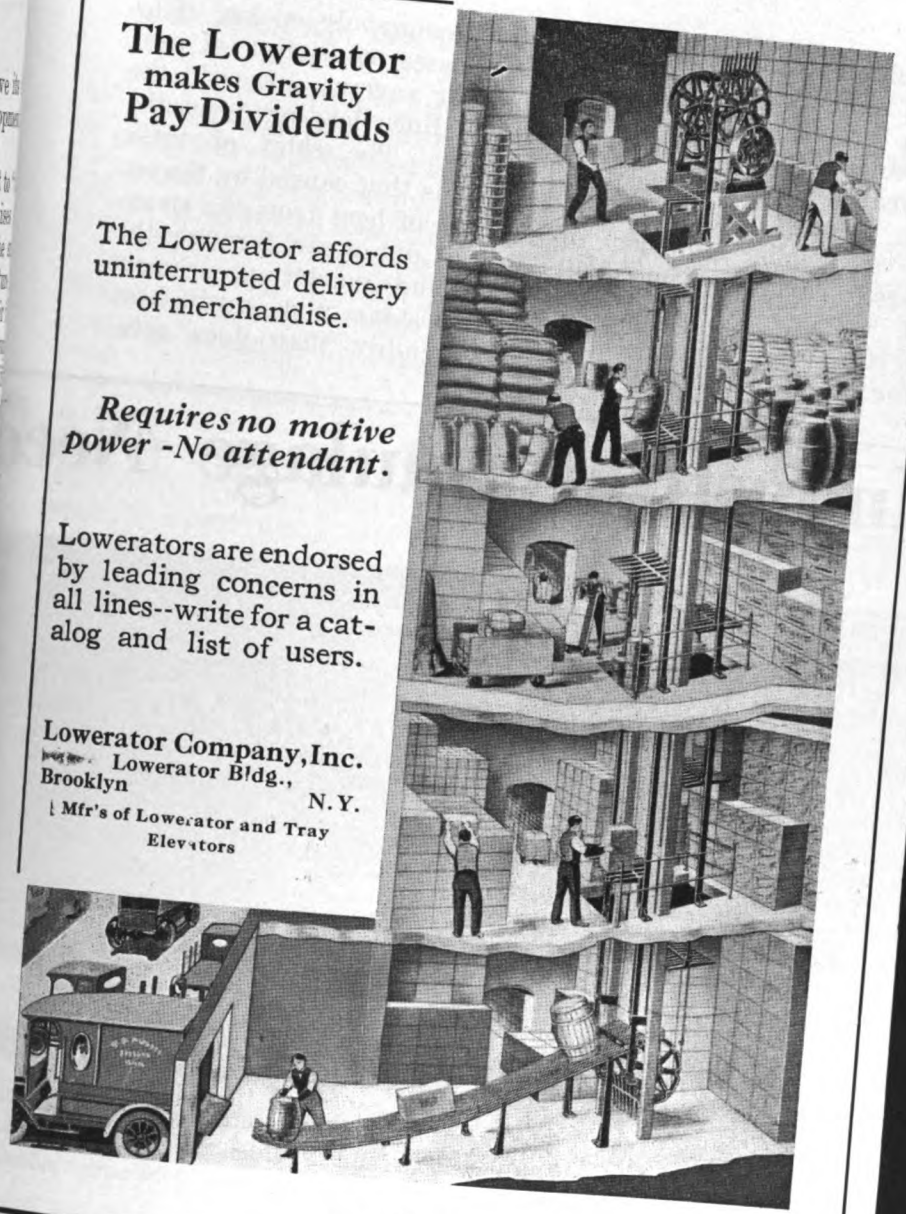
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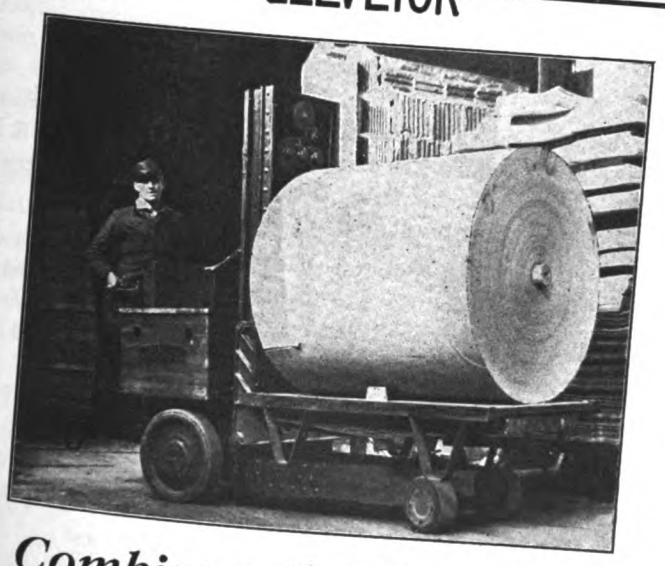
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HERE is a newer and better way to heat your plant. Skinner Bros. (Baetz Patent) Heater follows none of the principles of old time, unsatisfactory heating methods—it is revolutionary in design—the pioneer of its type.

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A Heater and Ventilator Combined

The Skinner Bros. (Baetz Patent) Heater can also be used as a ventilator—it is so arranged that fresh, pure air can be drawn through the heater, in practically any quantity desired and circulated throughout the plant.

No bulky system of outside pipes or ducts is used in the Skinner Bros. (Baetz Patent) Heater—the building interior can be kept free and open and the cost of pipes and ducts saved.

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Send for Catalog D-9—it fully explains the principle of this marvelous heater.

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Skinner Bros. *Baetz Patent* HEATING SYSTEM

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(*Continued from page 40*)

eal use of the moving medium. It has been only in recent years that a more thorough and intelligent understanding of the principles involved has made possible the development of equipment for the generation and utilization of superheated steam for the development of power in an economical way.

It is but natural that this development found its way first into the large central stations, where the cost of power was 100 per cent. of the cost of the finished product. The operating economies obtained were evidence of the practical value of the principles involved and offered an incentive for the gradual introduction of similar equipment into industrial power plants. Today the power plants of many industries throughout the country are equipped with superheaters and with engines or turbines specially designed for superheat.

From the standpoint of efficient operation and economical power costs, the advantages of the superheated steam plant are manifold. Modern boiler design has made possible high operating efficiencies that were not possible years ago. The addition of a superheater unit to such an installation will naturally result in a greater coal consumption for any given quantity of steam evaporated and superheated. Actual tests, however, have shown that a greater amount of heat is absorbed and transmitted to the steam for a given weight of coal burned under a superheater installation than under an ordinary boiler. In other words, the over-all efficiency of a superheater plus boiler is slightly greater than that of a boiler alone, providing the superheater is properly designed and located. Obviously the addition of a superheater can have no effect upon the combustion efficiency in the furnace itself. It does, however lower the temperature of the gases leaving the boiler after they have passed over tubes and given their sensible heat to the water and the steam. This reduction in the temperature of the flue gases is an indication of a similar reduction in the amount of sensible heat lost up the stack. Just what this saving amounts to is difficult to determine by test, but the increase in efficiency is certain.

The installation of a superheater also has the effect of decreasing the load upon the boiler itself, since a smaller amount of superheated steam will do the same useful work than if the steam were dry saturated, the chief reason being that condensation losses are eliminated. The consequent reduction in load on the boiler may sometimes represent an appreciable saving in the wear and tear on the equipment. In some cases it may enable a smaller number of boilers to carry the same plant load.

In the operation of every power plant there are certain losses commonly spoken of as line losses, consisting of heat lost for various causes in the steam lines leading from the boilers. The chief of these losses is that caused by the radiation of heat from the steam to the outer air through the pipe and insulation. Superheated steam gives up its heat less readily than does satu-

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The General Electric Company builds complete locomotives—to insure well balanced design, both electrically and mechanically. G-E Locomotives of standard design are available for general industrial

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rated steam and this loss is, therefore, minimized when superheated steam is used.

The radiation of heat from steam lines will cause a certain amount of condensation in the case of saturated steam, whereas superheated steam may lose a few degrees of temperature, but it will still remain steam and be available for expansive work when it reaches the engine or turbines. Line condensation for saturated steam is often in excess of 5 per cent. of the total steam carried.

So far we have considered only the minor losses involved in the distribution of steam from the boilers to the prime movers. In every case the losses with saturated steam have been greater than with steam at a suitable superheat. Added together they may often amount to quite an appreciable figure.

But the greatest and most important loss of heat, work and power in the use of saturated steam as compared with superheated steam is the condensation of the steam when it comes in contact with the cylinder walls of the reciprocating engine. This initial condensation is seldom less than 20 to 30 per cent. of the total weight of steam entering the cylinder, leaving only 70 to 80 per cent. of the steam available for useful work.

If the entering steam were superheated, on the other hand, the cooling effect of the cylinder walls would be sufficient to reduce the temperature of the steam to the saturation point before any condensation would take place. With 100 degrees superheat the temperature would have to be reduced 100 deg. F. Condensation will be eliminated if the steam is superheated sufficiently to permit of cooling without reaching the saturation temperature.

A single or twin cylinder simple engine offers the most severe condensation conditions to the entering steam. The steam expands from line pressure to atmospheric pressure on the forward stroke and is exhausted on the return. The cylinder walls are, therefore, cooled by low temperature steam just prior to the admission of high temperature steam for the next stroke. Compound engines, where steam is expanded in a high pressure cylinder down to an intermediate pressure and from there further expanded in a low pressure cylinder down to atmospheric pressure, offer a more moderate temperature range between the entering and leaving steam, and the condensation and counteracting superheat required is proportionately less than would be necessary for a simple engine.

Accurate figures on the savings possible through the use of superheated steam in reciprocating engines are difficult to obtain. Well-designed economical engines use a small quantity of steam to develop their rated horsepower. The amount of total cylinder condensation is proportionately low and the savings possible with the use of superheated steam are relatively small. Where the steam consumption is high, as in the case of uneconomical units, the possible economies increase proportionately. These savings may vary from 3 to 5 per cent. for 100 degrees of superheat in large economical plants using engines with a high ratio

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There is a Suitable G-E Locomotive



Storage Battery Uses

haulage conditions—and are easily adaptable to special requirements due to able engineering and ample production facilities.

Whatever you require for long heavy hauls—continuous peak load traffic—shifting at terminal—incoming and outgoing freight—short hauls between buildings, etc.,—there are suitable G-E Locomotives. You have but to submit the required duty and G-E engineers select the proper locomotive for the work.

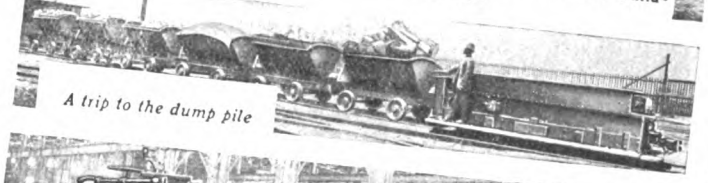
The G-E Locomotives shown here are of the Trolley, Third Rail, Storage Battery, and combination Trolley and Storage Battery types. More than views—they are evidence of the success with which G-E Locomotives meet, efficiently and economically, every industrial haulage need.

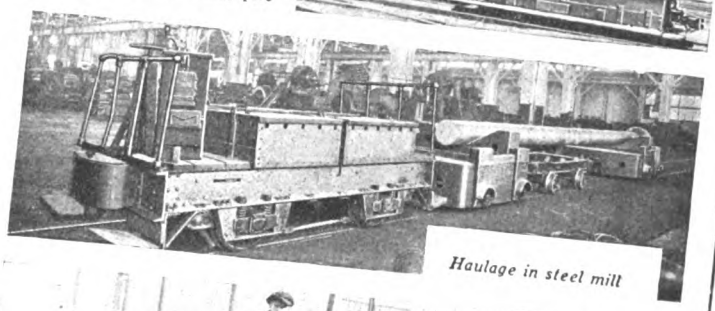
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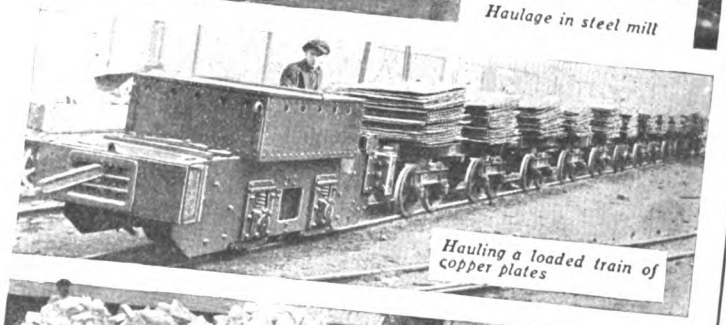
Interesting and valuable detail of the uses of electric locomotives for industrial haulage is contained in *Bulletin No. 44251* which will be mailed you free upon your request. Write for it today.

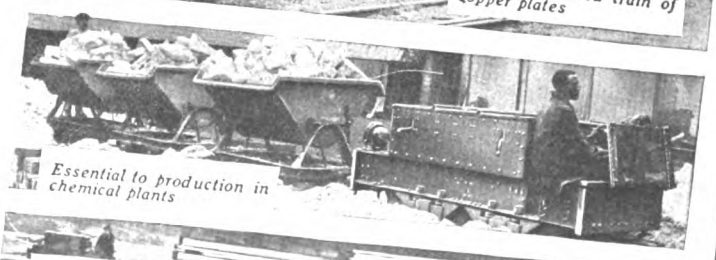

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of expansion, to from 10 to 25 per cent. for 100 degrees superheat where less economical units are employed.

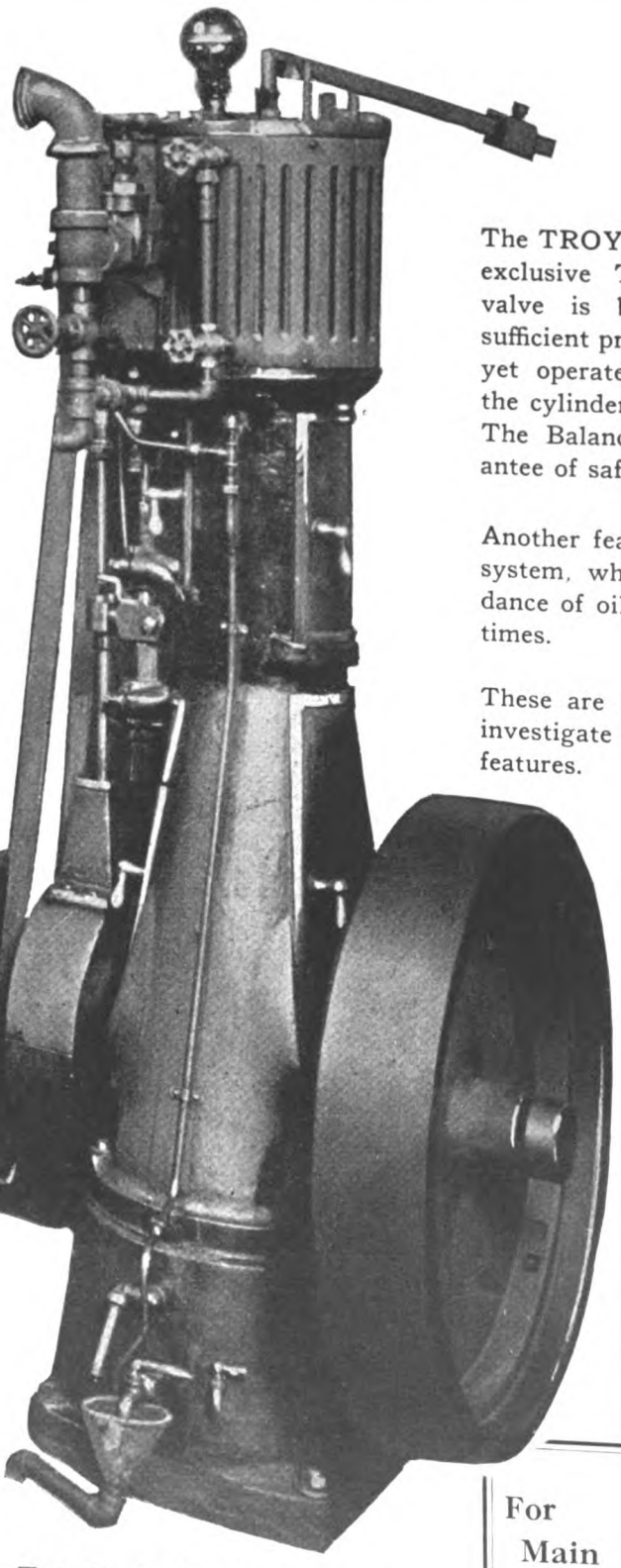
From the standpoint of operating economy the necessity of superheated steam is nowhere so vital as in the case of steam turbines. The rapid expansion of saturated steam as it passes through the blades of the various stages would produce sufficient condensation to cause serious trouble through the presence of water in the low pressure stages. Steam must necessarily be superheated for use in such types of turbines to avoid these difficulties.

The presence of moisture in steam passing through the turbine also has a detrimental effect upon the economy of the unit. Some authorities claim that a two per cent. loss will result for every one per cent. of moisture in the steam. It has been found that the water rate or steam consumption of a large economical steam turbine is reduced about one per cent. for every 12 degrees of superheat in the steam. This holds true approximately up to 200 degrees of superheat, at which the steam saving is approximately 16 per cent. On this basis, steam with 100 degrees superheat will effect a total coal saving of about 4 to 5 per cent. when operating an economical steam turbine, as compared to the operation of the same unit on saturated steam.

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A TROY ENGINE in your plant, is always a step ahead in economical plant operation.

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The TROY Balanced Valve is an exclusive TROY feature. This valve is balanced, except for sufficient pressure to hold its seat, yet operates freely and relieves the cylinder of any condensation. The Balanced Valve is a guarantee of safe operation.

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DEPENDABLE POWER with ABSOLUTE SAFETY

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"The industrial accident problem in America, which is now causing approximately 20,000 deaths and 500,000 injuries annually, will never be fully controlled until the public accident problem is controlled." C. W. Price, Vice President of the Elliott Service Company, New York City told the members of the American Society of Safety Engineers.

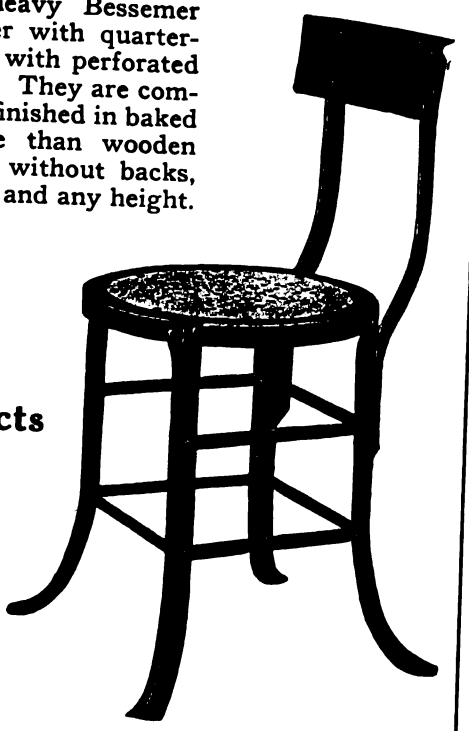
Some of the biggest industrial concerns in the country including the United States Steel Corporation, Mr. Price said have already come to this conclusion and are now actually giving the workmen in their plants instruction in the prevention of accidents on the street, in the home, and in other public places. Industrial executives, he said, are beginning to realize that it is easier to get workmen seriously interested in accident prevention at home and on the streets than in the plant because in the former case the lives of their wives and children are concerned and the average workman even of the lowest type is usually more interested in the safety of his family than in his own life.

"The question that we must consider, therefore, is whether safety can be organized in a community as it has successfully been organized in the great industries with a continuous campaign of education which will grip men, women, and children alike and cause them to stop being careless and cause them to be careful. Until very recently we could not truthfully say that such a thing was possible. My experiences convince me that it is now possible for any community to organize the work of accident prevention on as scientific and as effective a basis as it is organized in the modern industrial plant, railroad, or public utility."

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THERE'S A *Tycos* OR *Taylor* TEMPERATURE INSTRUMENT FOR EVERY PURPOSE.

Where Minutes Are Vital

(*Continued from page 20*)

"change of climate."

One other feature which does not show in the accompanying illustrations is the ceiling in the composing room. A single linotype machine operating in an ordinary room makes about as much noise as a typewriter. When you put a battery of fifty linotypes at work, there is what might be called considerable din.

In the *Tribune* composing room, the customary noise is conspicuous by its absence—a tribute to the unostentatious work of acoustic engineers. They have made a ceiling of perforated metal, superimposed upon felt; a combination which absorbs sound instead of reflecting it, and which looks, on casual inspection, for all the world like a ceiling made up of panels of dotted Swiss.

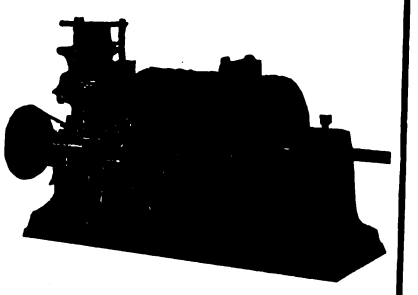
We have described these particular features at length, because neither of them is susceptible of explanation by illustration. To attempt to go into such detail regarding each and every feature would require a great deal more space than we have available. The accompanying illustrations with their captions, however, will probably serve much better than any extended word-portrayal to give a bird's-eye view of this most up-to-date newspaper plant.

The new *Tribune* building is, as a matter of fact, not merely a wonderful project; it stands as proof of the soundness of the principles on which modern production methods and modern management science are founded. The haphazard method has gone, the so-called "efficiency expert" has had his brief day; but true scientific management has proved that it is not confined to any one industry or to any single kind of industry, but to all industry.

Seen in a perspective of five years since the Armistice, there is much to justify the belief that European conditions are actually making definite progress towards normal. In many countries the economic situation is obviously better than it was a year ago.

(The Guaranty Survey)

Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway
New York

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670,000 Horsepower of Electric Heat

(*Continued from page 23*)

This furnace can be operated at higher temperature than the carbon resistor type, and, at the same time can be regulated to operate at lower temperatures economically but with the additional feature of automatic control.

The electric furnace, in actual use has reached the temperature of 3,500 C. Recent experiments in the Research Laboratory of the General Electric Company, have, however, developed a furnace which gives a temperature of 4,500 C. enough to volatilize diamonds. A comparison of these temperatures with that of the sun, which is estimated at 5,000 C gives a striking idea of what can be accomplished in handling refractory substances with electric heat.

There are other types of electric furnaces, which, although simple in construction, are capable of doing in one operation things which formerly took several heatings. In making shells, for example, for large calibre guns, it is necessary to expose different sections of the same shell to different degrees of heat. With an electric furnace this is done by simply combining heating units of varying resistance, according to the degree of heat desired, in the same furnace.

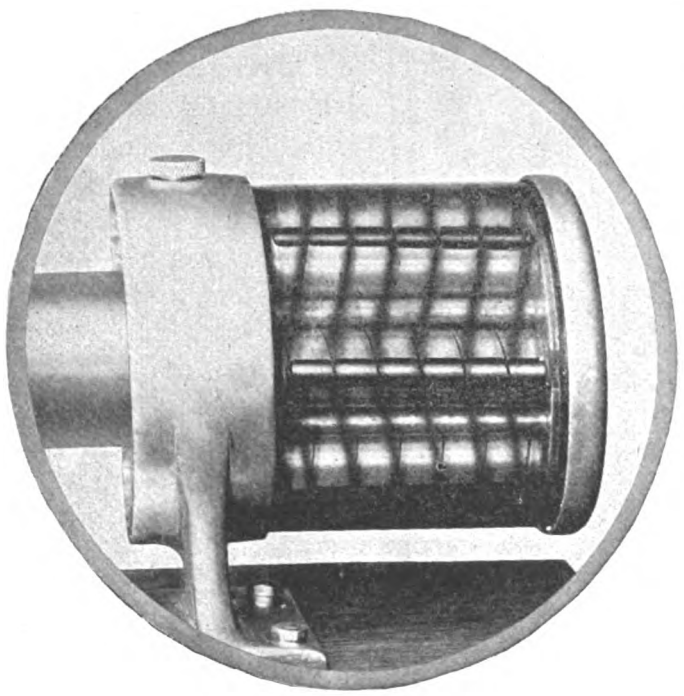
The war was responsible for many new devices designed with a view to increasing production quickly. One of the things the government needed most was ships—lots of them, and in building ships an enormous amount of rivets have to be heated, and that quickly. The usual methods of heating these rivets was in a forge, usually burning coke or oil as fuel, which, after a careful survey, was found to be woefully inefficient. The attendance was large, requiring a blower man as well as a passer, large quantities of rivets were burned, welded together, or insufficiently heated in the forge, and when it had to be taken into the hold of the ship for use, the difficulties of operation were only exceeded by the vileness of the atmosphere resulting from the fumes of the forge.

The result was the electric rivet heater. Rivets are now heated by inserting them between two heavy copper bars carrying a heavy current, supplied by a transformer. Since the iron of the rivets themselves is a material of high resistance, they are heated thoroughly and quickly. The bars are operated by a foot pedal, so that when the rivets are removed, or being placed in position to be heated. The current ceases to flow. The whole apparatus is easily portable.

It was found that this simple machine heated the rivets throughout, that inasmuch as the energy was used only when the rivets were actually being heated, there was no waste of heat, there were no noxious fumes, or spoiled and wasted rivets, and that the machine was nearly as fool-proof as it could be. The attendance was reduced to a minimum, and there was no necessity of sup-

(*Continued on page 49*)

Did You Ever See a Hyatt Roller Bearing *In a Glass House?*



Here is a Hyatt roller bearing mounted in glass instead of steel to enable you to observe the circulation of the oil.

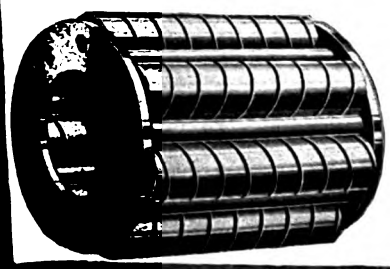
As the hollow rollers revolve, the oil flows out of the slots in parallel bands which cover the entire bearing surfaces. As long as any oil remains in the bearing it will be constantly picked up by the rollers and distributed in the path of the following rollers.

Because of this positive, self-oiling feature of Hyatt roller bearings it is only necessary to add lubricant to them occasionally, usually 3 or 4 times a year, which makes a worthwhile reduction in lubrication costs, oil and labor.

This positive, self-oiling feature of Hyatt roller bearings is only one of their good points.

Their true rolling motion saves power and manual effort in worthwhile amounts and their durable high grade steel construction enables them to effect these economies throughout the life of a machine without adjustment or replacement.

Specify Hyatt roller bearings for your cranes, trolleys, hoists, conveyors, for industrial trucks and trailers, machine tools, lineshafts and every kind of machinery where economy and dependability of operation are desired.



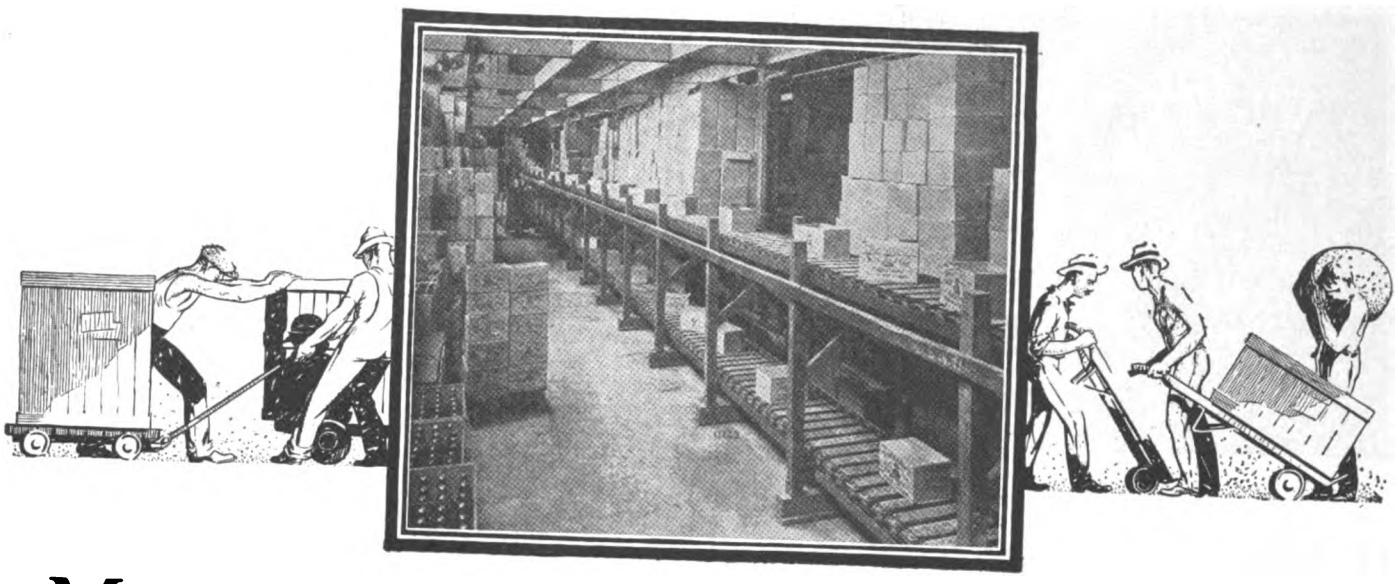
Hyatt Roller Bearing Company

Newark Detroit Chicago San Francisco

Worcester Milwaukee Huntington Minneapolis Philadelphia

Cleveland Pittsburgh Buffalo Indianapolis

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More Handled with Fewer Hands

A Correction

In our advertisement appearing in the August issue of Industry Illustrated, referring to Jeffrey equipment in the plant of The American Sugar Refining Company, it was stated that "the aluminum conveyor buckets described ..... were designed and installed by The Jeffrey Manufacturing Company."

While the equipment referred to is our well known Pivoted Bucket Carrier, we feel that the credit for its adaptation in design and installation to the particular needs of this plant of The American Sugar Refining Company should go to Richard Morton, Engineering Contractor of Baltimore, Maryland, through whose office it was handled.

(Signed)

The JEFFREY MANUFACTURING CO.

THE acute labor shortage existing today makes it imperative for every manufacturer employing one or more men for handling material to take immediate steps to cut down mounting labor costs.

Add men, and you add excessive labor costs. Add machinery and you multiply the effectiveness of the men you now have.

An installation of Jeffrey Labor Saving Machinery solves the labor problem permanently—it increases production—it makes bigger profits possible.

Wide experience over a half century has resulted in the development of a complete line of Jeffrey standardized conveying and material handling machinery.

Jeffrey Engineers will gladly help you in working out plans you may have for more efficient handling of material or in suggesting new economies in the manufacture of your product.

The Jeffrey Mfg. Co. 946-99 North Fourth St., Columbus, Ohio

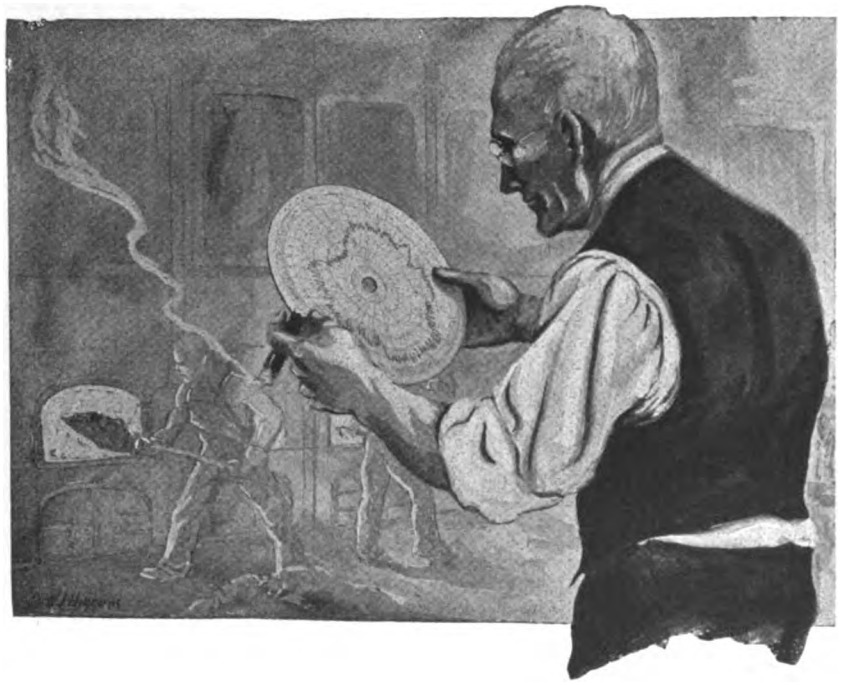
New York, 2008 Hudson Terminal Bldg. — **Chicago,** 858 McCormick Bldg. — **Pittsburgh,** Rea Bldg., 622 Second Ave. — **Philadelphia,** 515 Real Estate Trust Bldg. — **Montreal,** Canada, Power Bldg.

Cleveland, Ohio.....1519 Guardian Bldg.
Denver, Colo.....1751 Wazee Street
St. Louis, Mo.....606 Pontiac Bldg.
Detroit, Mich.....455 Book Bldg.
Milwaukee, Wis.....M. & M. Bldg.
Boston, Mass.....141 Milk Street
Los Angeles, Cal....H. W. Hellman Bldg.
Charleston, W. Va.....914 Kanawha Street
Scranton, Pa....518 Union Nat'l Bank Bldg.

JEFFREY

MATERIAL HANDLING *AND* MINING EQUIPMENT

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He has taken the place of the "stokers" of yesterday

ENGINEERING and mechanics have triumphed over the slip-shod firing methods of yesterday—and hundreds of plants are harvesting great savings in coal and labor costs.

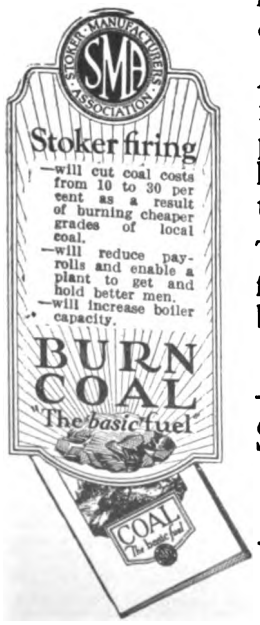
In place of the gangs of sweating human stokers is an engineer who smoothly directs the operation of mechanical stokers which respond automatically to the varying demands for steam.

In place of the old conception that an inferno of fire in a boiler furnace means heat, is the modern knowledge of just what each atom of coal is accomplishing—a knowledge based on the intensive study and research of the combustion engineers who have developed mechanical stoking.

In place of the old time struggle to "meet the peak loads" is the quickly responding mechanical stoker that will make a boiler produce steam many times in excess of its rated capacity.

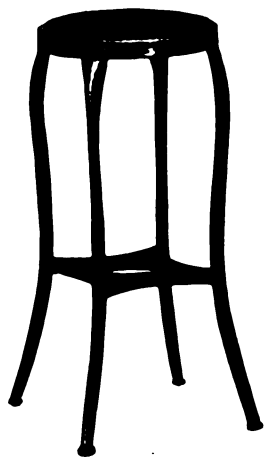
All this stoker firing has accomplished for industry—all this it will accomplish for you if your plant is still hand fired or is not fired by a scientifically applied mechanical stoker.

The exceptional possibilities of stoker firing are covered by an interesting book, "Coal—the basic fuel." Read it.



Stoker Manufacturers Association
G. A. SACCHI, Secretary
Lester Branch, Philadelphia

Uhl Steel Tool Trays and Stools for Factory Use



The Uhl Steel Factory Equipment line contains many styles and types of stools and tool trays, offering selections for practically every factory requirement. For nearly a quarter of a century they have been a favorite with institutions who demand utmost durability and economy in equipment and their users include many of America's greatest corporations.

UHL Steel Stools

Uhl Steel Stools solve the seating problem once and for all. Every detail of their construction reflects quality materials and skilled workmanship. No stools on the market are more durable or comfortable. They eliminate up-keep cost and outwear any other stools made. Our service records disclose countless instances where Uhl Stools are still rendering satisfactory service and still retain their sturdiness and shape after fifteen years of hard usage.



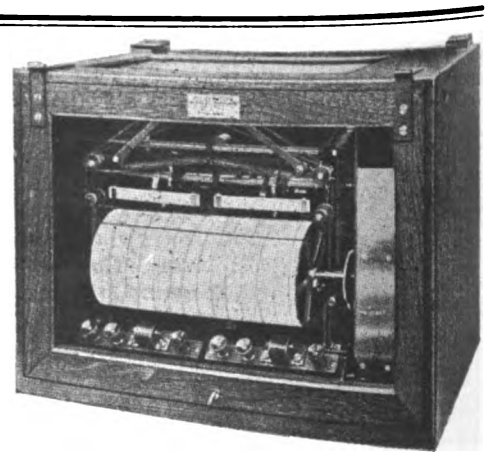
UHL Steel Tool Trays

Uhl Steel Tool Trays fullfil hundreds of needs in industry. In the tool room, garages, lathe room, foundries, machine shop—wherever there are tools and equipment to be moved about, Uhl Tool Trays save hours of valuable time each day, in addition to providing a convenient, safe place for storage when tools and other equipment are not in use. Uhl Trays are indestructible, each one being made to withstand the hardest usage. All cold-rolled steel—nothing to break. No upkeep expense. Easily handled. Quotations and other details gladly furnished.

The Toledo Metal Furniture Co.
1620 Hastings Street **Toledo, Ohio**

Manufacturers of
Uhl Steel Furniture, Typewriter Desks, Chairs, Tables, Stands, Vault Trucks and Factory Equipment

Co_2 Readings from 4 Boilers on the One Chart



Helps Solve an Important Boiler Room Problem

A 4-Point CO_2 Recorder—one of the types of Cambridge Recorders, made to show the comparative efficiencies of four boilers.

CAMBRIDGE ELECTRICAL CO_2 RECORDERS INDICATORS

Save time by having a continuous record of boiler performance right in front of the operator.
They are entirely electrical—no chemicals to renew—no glass or rubber parts to break or wear out. Can be installed any distance from the flue. As accurate as an Orsat with none of its faults or maintenance troubles.
Other Cambridge instruments—Electrical Distance Thermometers. Thermo-electric Pyrometers, Optical Pyrometers, Draft Gauges.
Send for List 157 X.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC)
MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

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(Continued from page 46)

plying fuel, with the consequent trouble in disposing of the ashes when it was being operated in more or less inaccessible parts of a ship. It has a capacity of 800 1/4" rivets 1" long per hour, which is enough under ordinary conditions for a gang of gun riveters.

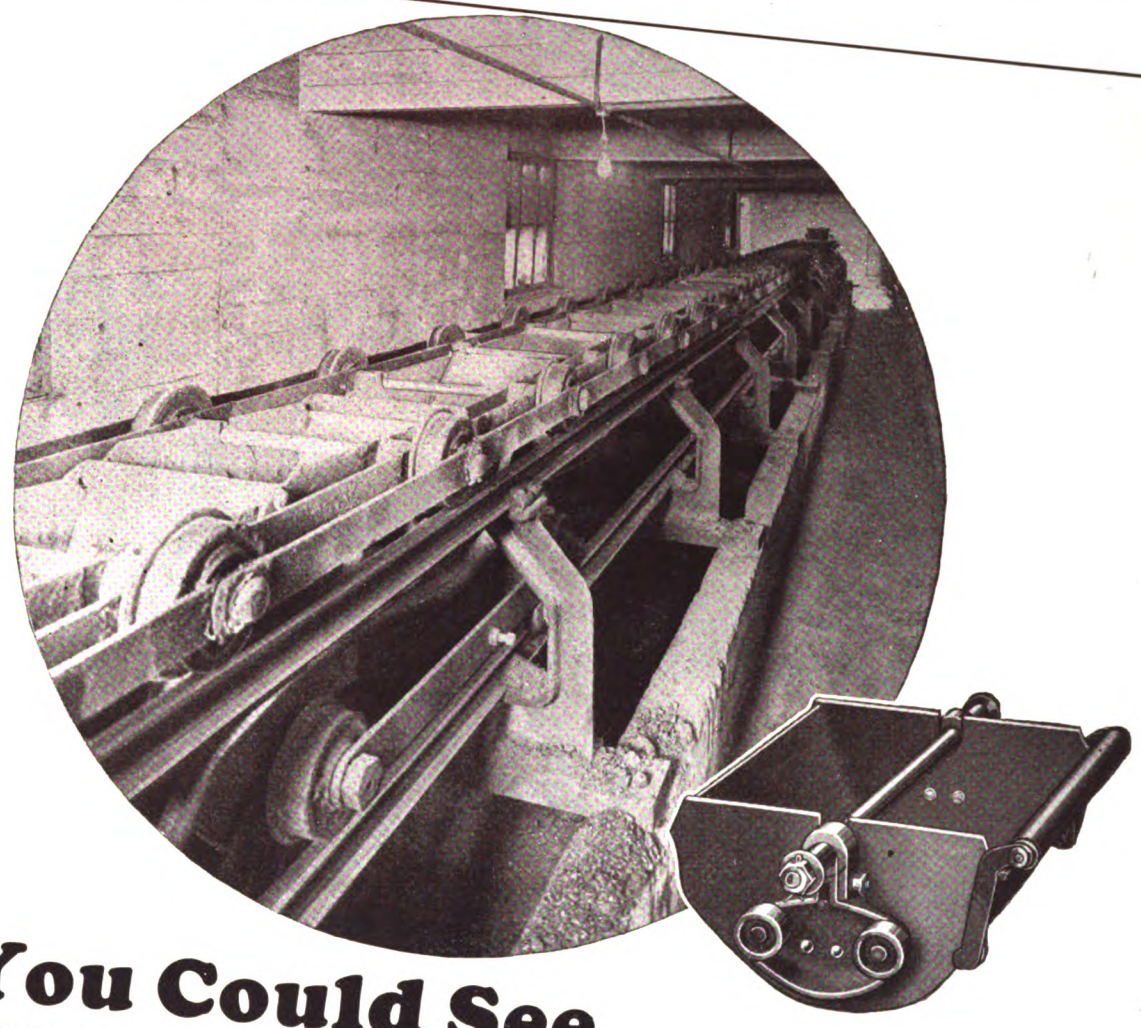
The place where electric heat has found its greatest application, from the standpoint of number of installations at least, is in electrically heated ovens or air drying and baking apparatus, as one prefers. It is surprising how many products that are necessities of our every day life require an oven treatment somewhere in the course of their manufacture.

Electric ovens are used more in the automobile industry than in any other field. Here 100,000 kw. are used in baking the japan on 3,000 automobile bodies every day. In a few years, the automobile whose japanned parts are not baked in an electric oven will be a rarity. Other large users of electric ovens are foundries, for baking cores, telephone and typewriter manufacturers, manufacturers of iron cots and bed frames and chemical manufacturers of various sorts.

Oven processes include baking, air tempering, drying and sherardising. Of these four the first is the most used, the other two are quite common and the last is a process for protecting exposed iron parts from corrosion.

In many of these processes, accurate regulation of heat, and automatic control are absolutely necessary, because many materials are irrevocably ruined by a slight change in the temperature of the oven. And here again, manufacturers have found that the saving in material which was spoiled by the vagaries of the fuel heated furnace, has more than paid for the increased expense of installing and operating a bank of electric ovens.

Of these three classes of ovens, those installed for baking are the most numerous. The work they do varies; baking japan on various articles, baking enamels, cores and colored inks on lithographic plates. The japan baking oven has been developed from the experimental stage in the past four years. The process of baking japan in fuel burning ovens, owing to the fact that volatile and explosive liquids such as naptha and kerosene are used as solvents, has always been a somewhat hazardous operation. The gases given off are of a highly explosive nature and more frequently these ovens have exploded with decidedly disastrous results. Another fault of this fuel oven was, that in baking the lighter colors of a japan, or enamels, soot from the gas sometimes would discolor the baking articles. Some of the ovens used in this work are of the conveyor type, so that loads can be loaded and unloaded while one is baking. The capacity of two of these ovens used in one plant is greater than that of six gas heated ovens formerly used to do the same work. It takes about three-quarters of an hour to complete a baking, in one factory where these ovens are largely used which more than doubled the number of loads finished per day, with a saving of 70 cents per load,



If You Could See

THE Perkins Pivoted Bucket Carrier At Work—discharging a continuous stream of coal on the upper run and ashes on the lower run of conveyor—at a tremendous saving of man power—

YOU would clearly understand the great preference for this ideal, economical conveyor. Your first impression will be quickly confirmed when you see how perfectly this bucket carrier works in the boiler room.

The Perkins Pivoted Bucket Carrier handles both coal and ashes with low operating and maintenance charges. It does the work mechanically releasing labor help for more profitable work.

Sturdily built and mechanically correct in design it insures years of reliable and dependable service. This is demonstrated by the number of Webster installations successfully operating in power plants today.

Our trained staff of engineers is at your service and will furnish particulars of this improved bucket carrier upon word from you.

THE WEBSTER MFG. COMPANY

4500-4560 Cortland Street, CHICAGO

Branch Offices

BOSTON ..... 902 Oliver Bldg.
BUFFALO ..... 572 Ellicott Square
CINCINNATI ..... 1914 Union Central Bldg.
CLEVELAND ..... 509 Swetland Bldg.
NEW YORK ..... 90 West Street
PHILADELPHIA .. 719 Commercial Trust Bldg.

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Birmingham, Ala. ..G. R. Mueller, Brown-Marx Bldg
Denver, Colo. ..... C. L. Dean, 1718 California Ave.
Detroit, Mich. .Palmer-Bee Co..2778-2794 E. Grand Blvd
Knoxville, Tenn ..Webster & Co., Holston Bank Bldg
Louisville, Ky. .E. D. Morton & Co., 516 W. Main St.
Memphis, Tenn..E. C. Atkins & Co., Maine & Butler Sts.
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New Orleans, La., Globe Supply & Machinery Company, 625-627 S. Peters Street
Pittsburgh, Pa. ..Dempcy-Degener Co., 708 Penn Ave.
Salt Lake City, Utah, L. W. Mendenhall, 517 McIntyre Building
Salt Lake City, Utah ..... Gallgher Machinery Co.
Seattle, Wash., The Brinkley Company, 651 Alaska St.
Vancouver, B. C....B. C. Equipment Company, Ltd., 613 Bank of Nova Scotia Bldg.

Canadian Factory-Sales Office: WEBSTER-INGLIS, LIMITED, 14 Strachan Ave., Toronto, Ont.

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which ran up into thousands of dollars when figured on a daily basis. The quality of work turned out is superior to that of the old type, it requires little or no attendance and the fire hazard is largely eliminated.

In speaking of japan it is interesting to know that a new type of japan is being developed which consists of an emulsion of the asphalt base with water, thus removing the fire hazard besides being much cleaner to handle. This process is called water japan.

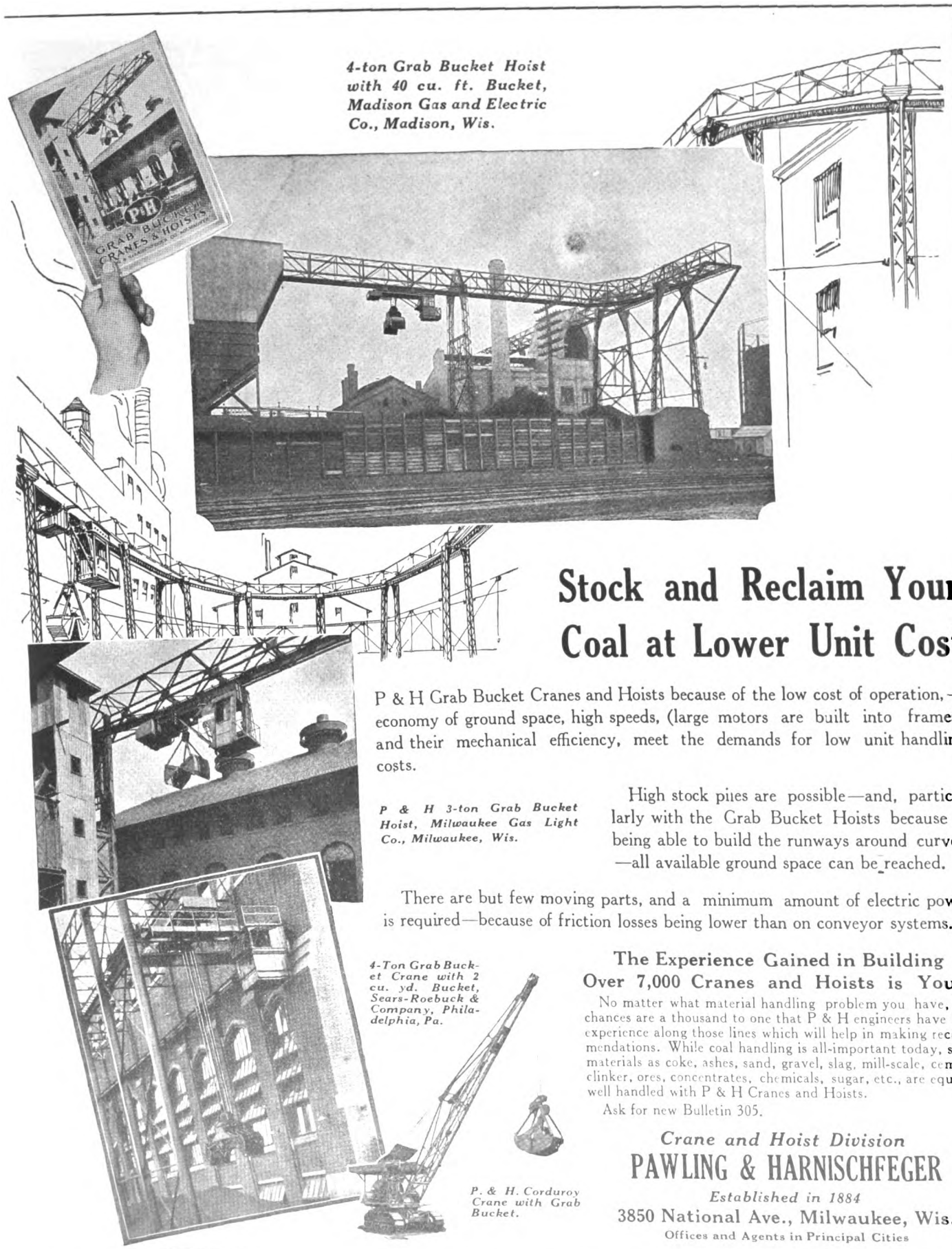
Ovens are used for many other purposes; sterilizing dental instruments, baking effervescent salts, and drying all sorts of products requiring well regulated heat and a clean atmosphere in the oven itself. The fact that their temperatures can be so exactly regulated, and absence of a mass of fuel carrying pipes, fumes, soot, and other by-products of burning gases, make the electric oven ideal for this purpose.

The fourth process mentioned, electric sherardizing is a patented process for protecting exposed iron parts from corrosion due to exposure to the weather. Briefly, it consists of baking these articles, together with zinc dust in a revolving oven. They are given a coating of zinc that has proven superior in resisting corrosion to any form of galvanization, or other protection heretofore used. Even pin holes and sharp corners, screw threads and other accessible places are evenly and thoroughly coated by the process.

Besides ovens, furnaces, and the other devices mentioned there are a number of small "individual" electrically heated pots, furnaces, etc., for use in the shop, garage or even at home. In this class are compound melting pots, flue pots, metal melters, small furnaces and electric soldering irons.

Many of them are easily portable, in fact can be attached to almost any lighting or shop circuit. For work in a book bindery or pattern shop for instance, the electrically heated pot keeps the glue continuously at just the right temperature for use, but never burns it; the same may be said of the compound melting pot and the lead or babbit melter, which are ideal for work and around a garage or in a factory. As for the soldering iron, any one who has used the gas heated type on top of a ladder, or in some accessible place need not be told the advantages of an iron that is always hot and still light and well balanced enough to be used with accuracy and comfort to the operator.

In spite of its growth in the last few years, the application of electrical heating to industry is only in its infancy. The time will undoubtedly come when the effort to conserve our natural coal and gas resources will cause it to assume much larger proportions. There is generally no limit to its possibilities of development not only as applies to factories, but in offices and homes. The saving of floor space, cleaner and more healthful working conditions, to say nothing of the improved speed of production and superior quality of work done, all tend to make its universal adoption but a matter of a comparatively short time.



4-ton Grab Bucket Hoist with 40 cu. ft. Bucket, Madison Gas and Electric Co., Madison, Wis.

Stock and Reclaim Your Coal at Lower Unit Cost

P & H Grab Bucket Cranes and Hoists because of the low cost of operation,—economy of ground space, high speeds, (large motors are built into frames) and their mechanical efficiency, meet the demands for low unit handling costs.

P & H 3-ton Grab Bucket Hoist, Milwaukee Gas Light Co., Milwaukee, Wis.

High stock piles are possible—and, particularly with the Grab Bucket Hoists because of being able to build the runways around curves,—all available ground space can be reached.

There are but few moving parts, and a minimum amount of electric power is required—because of friction losses being lower than on conveyor systems.

4-Ton Grab Bucket Crane with 2 cu. yd. Bucket, Sears-Roebuck & Company, Philadelphia, Pa.

P. & H. Corduroy Crane with Grab Bucket.

The Experience Gained in Building Over 7,000 Cranes and Hoists is Yours

No matter what material handling problem you have, the chances are a thousand to one that P & H engineers have had experience along those lines which will help in making recommendations. While coal handling is all-important today, such materials as coke, ashes, sand, gravel, slag, mill-scale, cement clinker, ores, concentrates, chemicals, sugar, etc., are equally well handled with P & H Cranes and Hoists.

Ask for new Bulletin 305.

Crane and Hoist Division

PAWLING & HARNISCHFEGER

Established in 1884

3850 National Ave., Milwaukee, Wis.

Offices and Agents in Principal Cities

P&H CRANES and HOISTS

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Training the Inexperienced Worker

(*Continued from page 13*)

worn out plan of "absorption."

Then the war came and our young men were leaving the industries like "rats from a sinking ship" because of the opportunity offered to serve their country, and it became necessary to quickly induct inexperienced hands into our plants and shops and train them for single purpose operations in order to rapidly produce war necessities. Then the call came to all who had gained experience and knowledge along the line of Vocational Training; directors and instructors were sought far and wide, and through the efforts of the Council of National Defense, these men were placed in all our large industries to develop and install "Training Departments" or as the English would say, Vestibule Schools.

Industrial training gave the manufacturers of America such a wonderful service during the war that immediately after the signing of the Armistice the wise employers decided to continue the "Schools" and those who were unable to secure training directors during the war were the early bidders for the available leaders of this important work who had been released by "War-Baby" concerns that had to close their doors.

The Winchester Repeating Arms Company did some training during the war and was successful in any attempted, and as early as was prudent after the reconstruction period the management immediately considered the policy of testing training, upgrading and adjusting all new or inefficient employees who were entering the plant or already employed there.

It might be well to explain what is meant by a "Vestibule School" in an industry. The English idea was that in order to properly induct "green hands" into their plants and introduce them to the processes peculiar to the individual industries, it was necessary to have a building or room in or near the plant where these new-comers could first be taught the shop customs and spirit, safety rules, checking-in and -out methods, shop decorum, getting acquainted with shop environments, overcoming nervousness as well as being instructed and trained on the machine or bench previous to being sent into the plant proper on production work.

Thus it will be seen that the term "vestibule" is intended to convey the thought of a vestibule to a theater, trolley car, etc., where the persons entering have time to adjust themselves, get their tickets, remove their outer clothing and become prepared to enter, calm and collect, ready to continue unruffled and with a clear mind and understanding of what they are to do.

At The Winchester Repeating Arms Company "The Central Training Section" was used to receive and train the larger part of the new help em-



Casting a Big Shadow

A NEW Mercury tractor is coming. It's already throwing a big shadow over the industrial tractor field.

A need has long existed for a machine of this kind that would attain a standard of work-output efficiency impossible in the best models now in use. The Mercury organization has met this need. A new era in industrial transportation is thereby ushered in.

You will want to know all about this revolutionary development, and how it makes possible 25% more work from the same expenditure of energy. We'll be glad to tell you or send our new Type H bulletin on request.

Mercury Manufacturing Company

4119 S. Halsted Street

Chicago, Illinois

When writing advertisers please mention Industry Illustrated

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ployed, (See Fig. 1) for the Training Department controlled more than a "school room," as the nature of the training activities at the Winchester Repeating Arms Company's plant covers "Segregated Sections" (Fig. 2) as well, and as these are controlled by the Training Organization it was necessary to make the scope of training broader.

The Segregated Sections of training are fenced off rooms which are installed in the plant departments when it is imprudent to move the equipment and work to the centralized section. In all such cases the room is usually partitioned off with standard shop partition and an instructor selected who is capable of properly training in the cunning handwork of the work he is teaching.

The reason why these sections are sometimes segregated is because the peculiar nature of the work to be trained on requires the learners to be near to the atmosphere of the work to be learned or the equipment is too heavy to be moved to the central training section. However, it is not always best that the learners be near to the old hands while in training.

All instructions are given on actual production work, (See Fig. 3) which gives the trainees the proper impressions and causes them to perform with care, under actual shop conditions, the operation to which they are assigned, so that upon promotion from training to the plant proper the trainee finds no difference in the methods of handling the job trained on or in the equipment used in producing the work.

One of the main reasons why a Training Department is of importance to a large industry is that in event new-comers try one operation and do not succeed, or show a dissatisfaction for the job, they can be quickly transferred to other jobs in the Training Department until misunderstandings and difficulties are smoothed out and the man properly placed, thus cutting down the abnormal turnover experienced by manufacturers in most plants at the present time.

The "Intentional" Training Method eliminates waste because all beginners are properly "shown how" and watched until proficient before they are allowed to try their hand and then are carefully shown again in event of a mistake or misunderstanding. In case the help in training is not absorbed by the plant departments, due to sudden changes of schedule or reduction of inventories, they are kept in the Training Department turning out the same production work as the shop, with the additional advantage of being on hand when needed in an emergency.

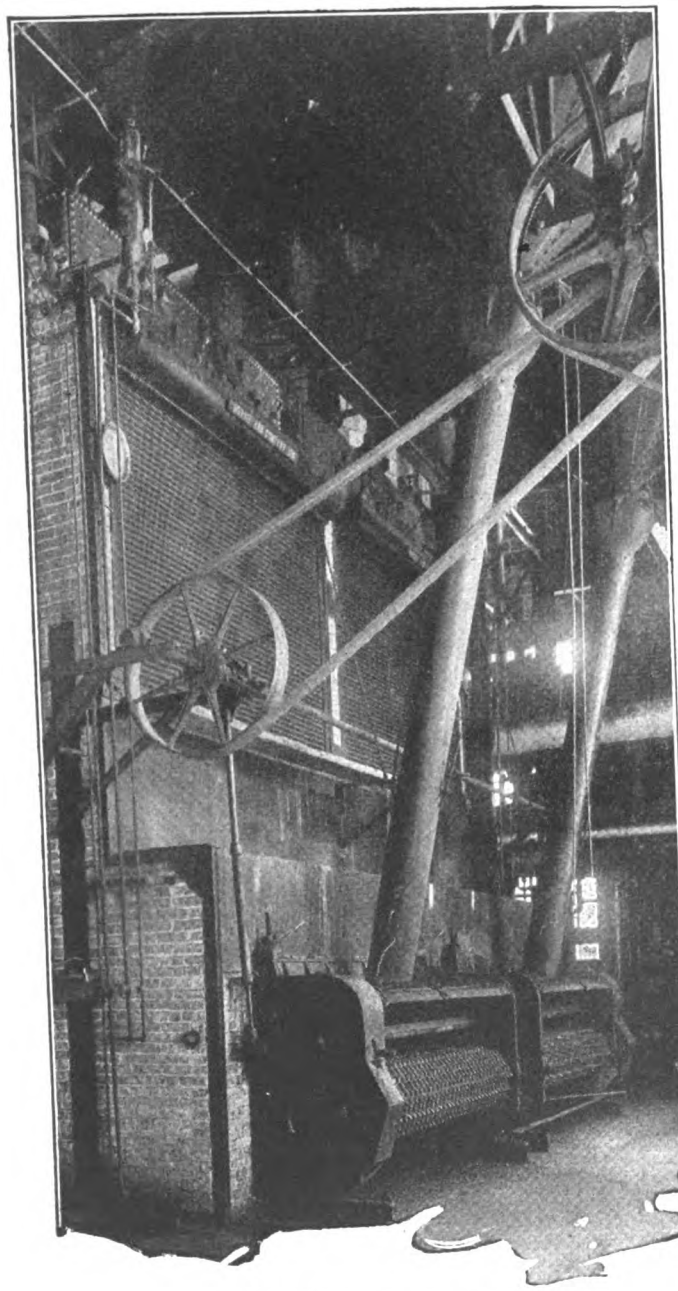
There is also this advantage when a Training Department is in operation: If perchance the plant department foremen discover inefficient employees, they may be sent to the Training Section covering the operation they are working on, and, when "upgraded" they can be returned to the shop as better operators and more satisfied workmen.

The W. R. A. Training Department developed some 90 sections of training for operatives, following are a part of

(Continued on page 54)

MORRIS





THE name of Morris has for 65 years been outstanding as a pioneer in the packing industry throughout the world. Wherever civilization has reached, Morris Supreme Products are well and favorably known.

For its power plants on two continents, Morris & Company has chosen Edge Moor Water Tube Boilers. In the past sixteen years, 33 Edge Moor Boilers of 13,618 aggregate horsepower have been placed in service in all Morris plants from Illinois to Argentine as essential factors in the production of a yearly output of many hundred million pounds of foods.

These 33 boilers represent fifteen separate orders—strong evidence of the proved value and economy of Edge Moor design and construction.

The Edge Moor catalogue explains why these boilers have won preference in a score of leading industries. Your request will bring a copy promptly.

EDGE MOOR IRON COMPANY
Established 1868
EDGE MOOR, DELAWARE
New York Chicago St. Paul Boston Pittsburgh Charlotte

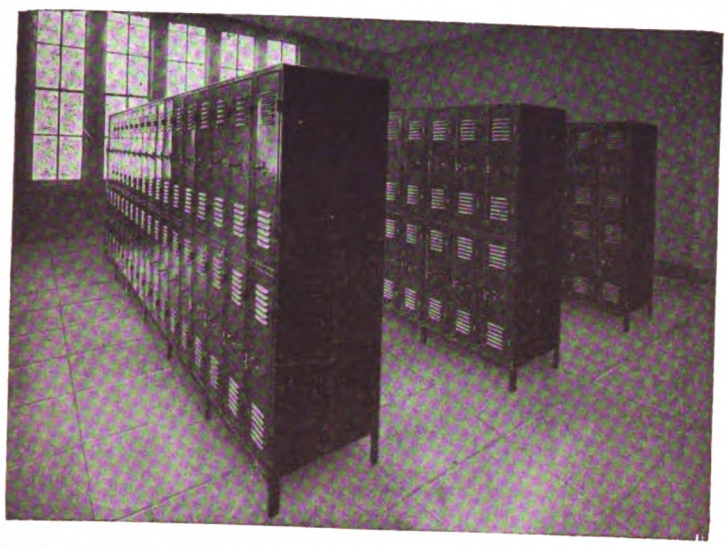
Two 498 H. P. Edge Moor Boilers in the Chicago plant of Morris & Co.

EDGE MOOR BOILERS
EDGE MOOR, DEL. U.S.A.

EDGE MOOR
Water Tube BOILERS
FOR INCREASED FUEL ECONOMY

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Wise employers of labor know that without the good will of their organization, nothing worthwhile can be accomplished in the way of cost reduction.

Providing safe, private storage for employees' clothes and personal belongings is an important step toward this ideal condition.

An installation of Berloy Lockers is tangible evidence of a real consideration for the workers' comfort.

Catalog Y-50 gives complete information.

BERLOY STEEL LOCKERS

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Pressed Metal Parts

15 Acres of Floor Space
100,000 Parts Daily

Our Estimates Will Show A Big Saving For You

To lower production costs is an ever-pressing, every-day problem. There are many manufacturers who have solved this problem at a big saving in time and money by discarding heavy, cumbersome castings and forgings and, in their place, using lighter, better and more uniform pressed metal parts.

We have specialized for more than 42 years in this work. Our plant has 15 acres of floor space and is equipped throughout with the most modern machinery.

G.P.&F. SERVICE
"KNOWING HOW SINCE '81"

G. P. & F. Service means that we can make for you high grade pressed metal parts in steel, brass, aluminum, copper, tin plate, or sheet zinc, and deliver them **when** and **where** they are wanted, at a lower cost than if you manufactured the parts in your own plant.

No matter how difficult or intricate your designs may be we guarantee to execute them to your complete satisfaction and make the parts to your order in any desired quantity.

We also are equipped for Gas and Electric Welding, Tinning, Galvanizing, Japanning and Porcelain Enameling.

Send us a sample or blue prints for estimates.

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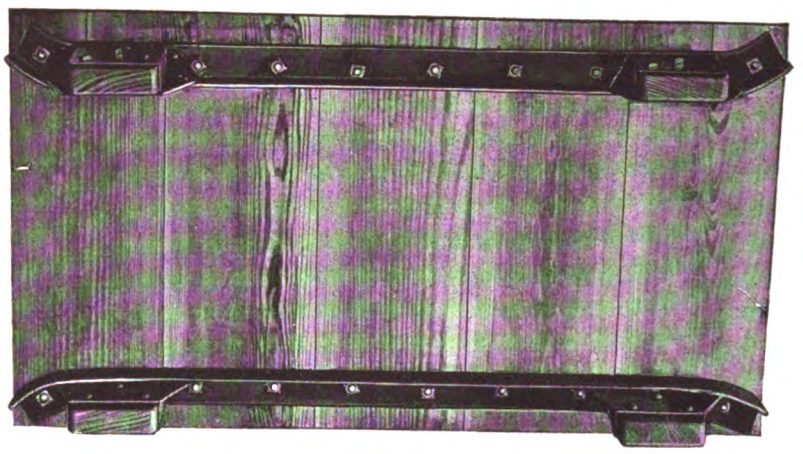
HALLOWELL
STEEL LIFT TRUCK PLATFORMS



The "Hallowell" Runners are constructed of heavy angle steel to which are attached steel leg holders of a special and substantial design. These parts are joined by large rivets, hydraulically driven, a method which prevents any possibility of their working loose.

This detail of construction is of vast importance as unless the legs are rigidly and permanently attached to the runners they will gradually become wobbly and unreliable.

The "Hallowell" joints remain tight—they cannot do otherwise.



Ends of runners are flared, as shown by above illustration, an exclusive "Hallowell" feature, which greatly simplifies entering the truck.

The value of this feature is soon realized by the workman after platform is put into service.

STANDARD PRESSED STEEL CO., JENKINTOWN, PA.

(The "Pioneer" Steel Hanger People)

INVESTIGATE

STANDARD PRESSED STEEL COMPANY, JENKINTOWN, PA.
Gentlemen: Kindly send me full details and prices of "Hallowell" Steel Reinforced Platforms.

Name.....
Company.....
Address.....
Truck used.....

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Two Kinds of Count— Two Kinds of Result

Count the product while the machine operator *works* — and the count shows *real work!*

Count it after the operator finishes his day, and it figures about what it would without counting at all.

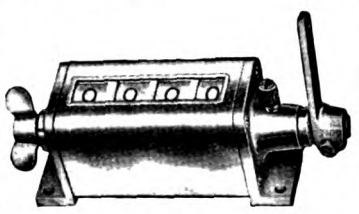
The record made when the *effort* is made, is what keeps the worker intent on doing his best. It's kept before him *automatically* by a

Veeder
COUNTER

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable to experimental work. If run backward the counter subtracts. Price $2.00. (*Cut 3/5 size.*) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also $2.00.



The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price, with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, $11.50 (list).

FREE—This new 80-page booklet shows everything you could ask in a counter ASK for it.



The Veeder Mfg. Co.
63 Sargeant St., Hartford, Conn.

(*Continued from page 52*)

the operations: Gun Polishers, Screw Polishers, Milling Adjusters, Drop Forgers, Knife Polishers, Knife Assemblers, Knife Sharpeners, Press Operators, Bench Assemblers, Scissor Bow Strappers, Electrical Helpers, Sheet Metal Helpers, Buffers, Wrench Polishers, Knife Hafters, Knife Glazers, Scissor Grinders, Scissor Assemblers, Bench Filers, Gun Machine Adjusters, Utility Service Men, Bamboo Rod Winders, Plier & Wrench Millers Machine Adjusters, Die Sinkers, Blanking Die Makers, Trimming Die Makers, Lathe Operators, Mill Machine Operators, Drill Press Operators, Sharper Operators, Planer Operators, Grinder Operators, Shop Clerks, Office Clerks, Fish Reel Assemblers, Battery Core Winders, etc.

Any man or woman who desires to learn a trade or occupation can do so by aplying to the Employment Department and asking about the opportunities this great plant has to offer, and again any man or woman already employed by the W. R. A. Co. can give advancement by applying to the personnel representative assigned by the company to canvass the shop departments.

A great many men who had worked in the gun division as common operators applied for an opportunity to *train* and develop as Gun Machine Adjusters which fits them, after learning to become foremen and later superintendents providing they have the right qualifications and ambition.

The equipment in the Training Department is typically the same as that used in the plant proper, (See Fig. 4) although in some cases improvements are made in order to facilitate a more rapid handling of the work. But when these improvements are discovered, the plant rapidly adopts the same and the equipment soon becomes universally used.

The length of time for learning varies according to the operation, but in all cases the training is intensive and a beginner is taught all the "short cuts" to aid rapid production before being promoted into the plant.

The method of training is governed by the operation to

(*Continued on page 56*)

Don't Say It! Write It!

A good plan to avoid error and shifted responsibility. A slogan which has helped production everywhere

but---

having written it—how is it delivered? Do you depend on costly and slow messengers who may lose it? or delay it? or forget it? Telautograph equipment, costing less than boys, will *deliver* messages as *rapidly as they are written* to one or fifty points simultaneously, and in the exact handwriting of the sender, in indelible ink! We can prove you need Telautographs—let us try now.

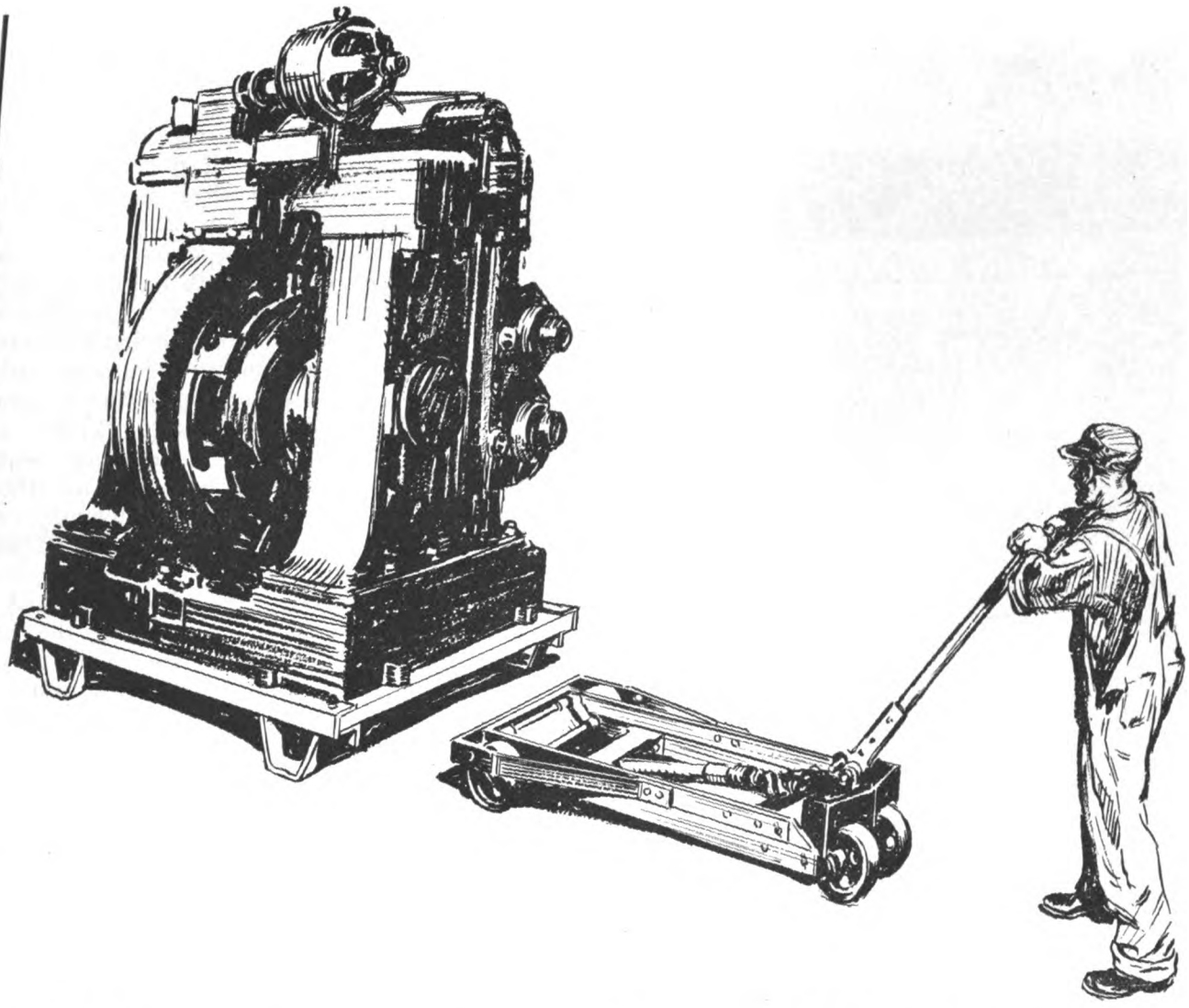
No Obligation!

We have 31 Service Stations in United States. We are now rendering service in 108 cities in the United States.

Telautograph Corporation

448 West 37th Street, New York.

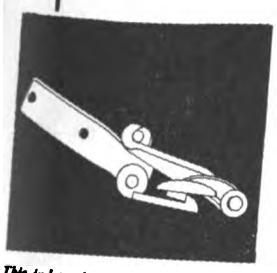
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There's no re-handling of materials when a Stuebing hauls the load

Here's a surprising fact: The money that is spent for unnecessary handling of materials, when hauled by ordinary four-wheel trucks, will buy Stuebing equipment *that will entirely eliminate re-handlings.*

And not only that. Stuebing Lift Trucks also enable *one* trucker to do the work of *five* men with ordinary trucks—an 80% saving of labor.



This independent lock, like every other part of a Stuebing, is given only one job to do. Designed with an unusually broad locking surface and built to hold loads tens heavier than truck capacity. No part of a Stuebing can be overworked—the secret of life-long wear and low upkeep.

These figures we quote, however, are based wholly on the use of *Stuebings*, which are different from any other lift truck made. The upkeep cost on a Stuebing is practically *nil.*

Here's an example: The upkeep cost on 98 Stuebings owned by the Firestone Tire & Rubber Co. of Akron, Ohio, has averaged less than 1/2c per day, per truck, over 4 years.

Now it stands to reason that your whole purpose in replacing your present hauling system with lift trucks is to save money.

So be sure that these savings are *permanent,* protected by low upkeep costs on your equipment.

The heads of the country's greatest industries will tell you that they chose Stuebings because their phenomenally low upkeep cost is not even approached by any other lift truck made.

No other lift truck is built like a Stuebing!

Write today for our complete 36-page catalog—a handbook on economies in material handling.

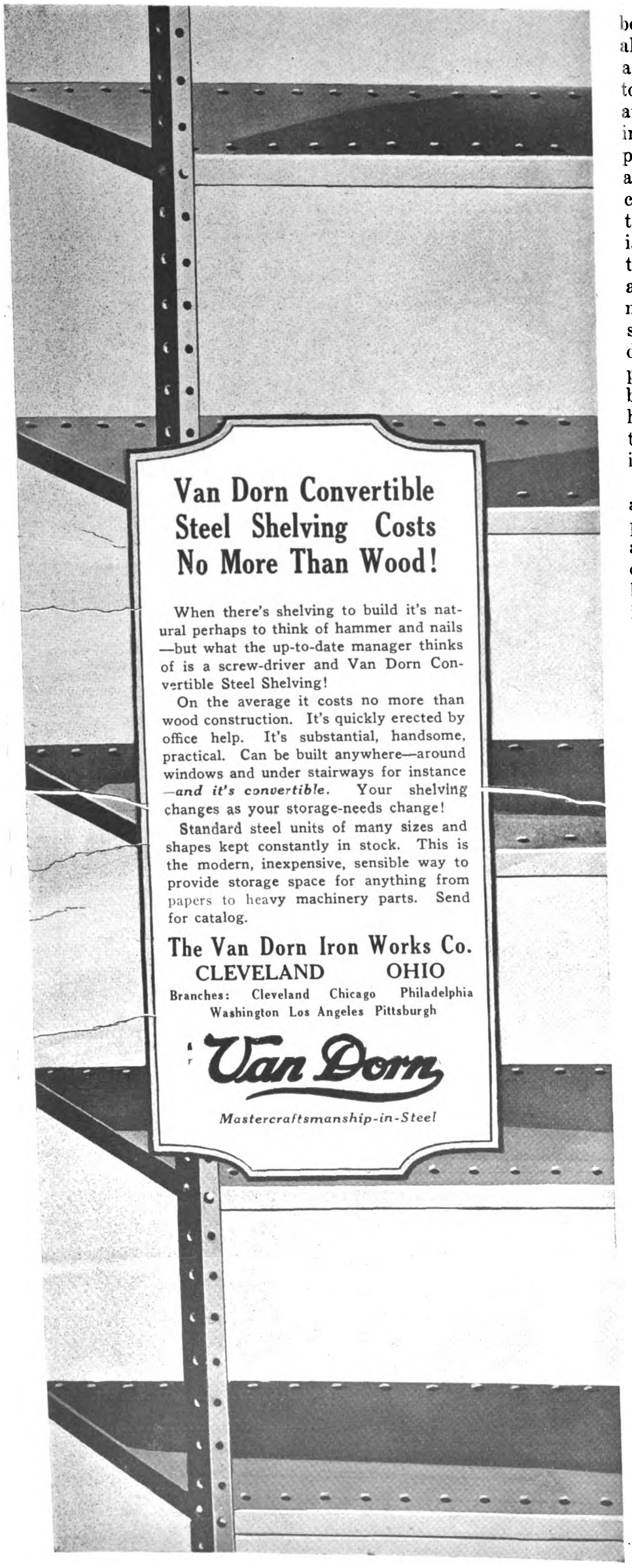
The Stuebing Truck Company, Cincinnati, Ohio; Montreal, Quebec

StueBing

LIFT TRUCK SYSTEMS

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(Continued from page 54)

be taught, but instructions are all carefully laid out on paper as a guide for the instructor to follow and are always clear and carefully presented. These instruction papers are prepared for the instructor as well as the trainee. These sheets cover all the important practical, theoretical and auxiliary knowledge pertaining to the trade, occupation or operation. The instructor does not necessarily follow these instructions in the order laid down, but proceeds with the practical work, being governed by the instruction sheets which he refers to from time to time to ascertain whether the training is being fully covered.

As a check on the instructor a set of question papers are prepared for each trainee to answer, and in event some question is asked which has not been covered by the practical instruction, the trainee is compelled to challenge the instructor regarding same, which brings to light the fact that some given point has not been explained. This gives the instructor an opportunity to cover the subject part at once, and thus fulfill the instruction aimed at.

The results achieved by this method have been very successful. Men trained as Sheet Metal Workers, Electrical Wiremen, Drop Forgers, Milling Machine Adjusters, etc., advanced very rapidly under this type of instruction. The men so trained went into the plant, enlightened and active in the work trained on, while the foremen and superintendents were greatly relieved of the training responsibilities by receiving men trained, as well as instructed in the W. R. A. methods and shop spirit.

An instructor must first be an expert workman, fully understanding all the cunning handicraft of his trade, or any separate operation of that trade. In addition to this handicraft knowledge, the instructor must develop the ability to impart to those whom they intend to teach, the knowledge they have acquired through practice. In other words, an instructor must be a master of the art which he is expounding.

The greatest care should be exercised when "picking" an instructor. Men selected from the regular shop field are preferred to those selected from outside sources, provided they are well directed. Plant executives will not recommend a man to act as an instructor of other men who will be used later as operatives in his shop, unless that instructor is one who has proven himself worthy and well qualified to carry on the operation he is to teach.

Every operation or process has certain "kinks" and "tricks" which are acquired by workers and absorbed by new persons entering the activity, and it is only through training that these points can be covered rapidly and without encountering the hazards liable to face men or women who are thrown into a plant and left to absorb what they can without a definite plan of instruction.

Then again, an instructor selected from the plant will usually perform the same while instructing others as he has done previously as a workman, and although he now has an opportunity for a larger personal expression and development, at the same time his ambition will always be to please the plant departments which he is serving through the Training Department.

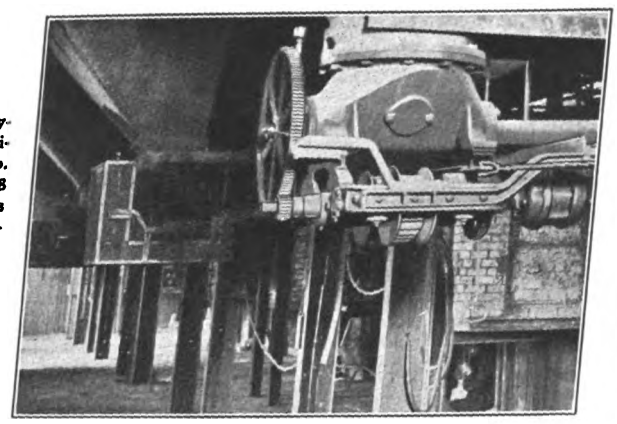
The environment of the Training Department is such that it invites suggestions from its instructors and many new ideas come to the surface which have been lying dormant for a long time.

A workman selected as an instructor has to be open minded and broad gauged if he intends to make good.

The most successful instructors are those who are agreeable to suggestion and willing to impart the knowledge pertaining to their trade, and have no secrets up their sleeves, who are above reproach and clean, upright men and women. Instruction data is furnished them and they use it as a guide when teaching. It is not always possible to supply such data at first when an operation for training is opened, as the first move necessary is to get the practical equipment started, but all operations no matter how simple should be covered by instructional guides and question papers before the trainee can be prop-

(Continued on page 58)

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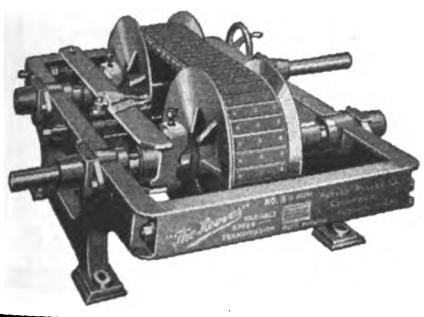
Courtesy of Raymond Bros. Engineering Co., Chicago. Installations of 8 No. O-D Reeves Transmission, Illinois Malleable Iron Co.

"The Reeves"

VARIABLE SPEED TRANSMISSION

INFINITE SPEED VARIATION
Easily and quickly obtained

Simple to operate. Inexpensive to maintain. Reduces cost to such an extent that it pays for itself in a very short time.



"THE REEVES" Variable Speed Transmission, as now manufactured, represents the most perfect mechanism procurable for the purpose of transmitting VARIABLE SPEEDS.

Its appeal to users is based solely on its ability to not only save money but to increase production and improve the quality of his goods.

The eight annealing ovens shown above cut, formerly required a man at each furnace, as well as a complement of coal passers to maintain the proper heat. Since the adoption of "The Reeves" Transmissions on the new pulverize coal system, one tender and his assistant now operate the entire battery.

Write for 52 page illustrated catalog, L-44.

REEVES PULLEY COMPANY
Columbus, Indiana.

AIR For Every Industrial Purpose

Highly developed equipment and complete Engineering Service covering the following lines:

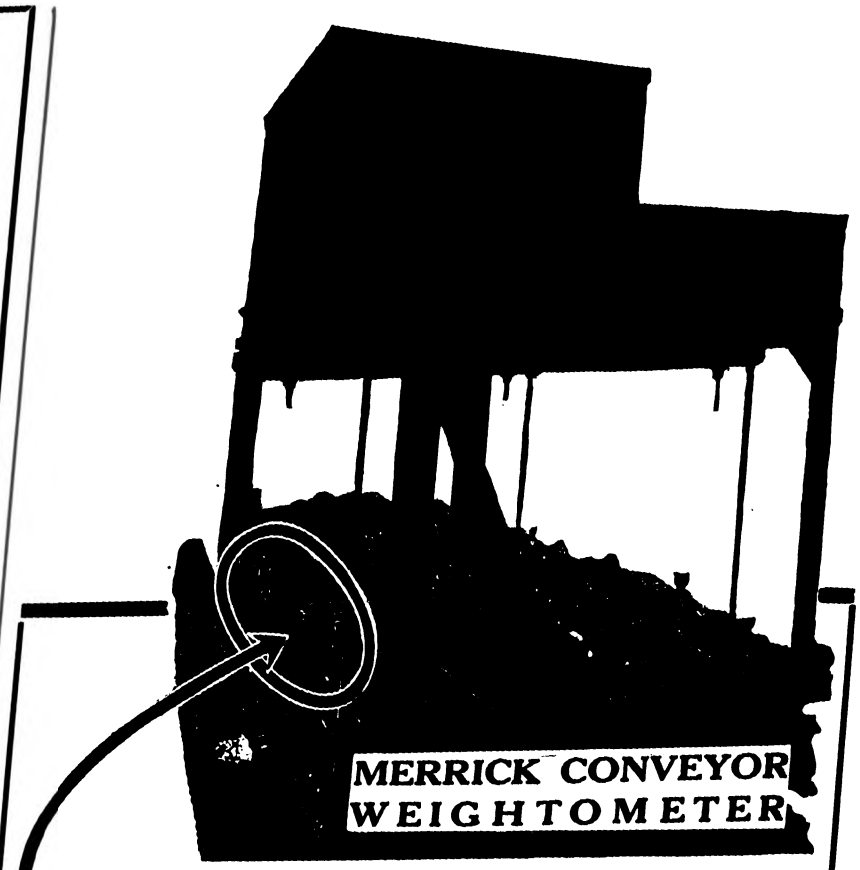
MECHANICAL DRAFT
HEATING AND VENTILATING
GENERATOR COOLING
AIR WASHING
FANS AND BLOWERS
STEAM ENGINES

Write for bulletins on air-handling problem that concerns you. We put at your disposal the knowledge acquired through forty successful years.

AMERICAN BLOWER COMPANY, DETROIT
CANADIAN SIROCCO CO., LTD., WINDSOR, ONT
BRANCH OFFICES IN ALL PRINCIPAL CITIES (332)

American Blower

"Sirocco" EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES
FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT



Right Here

is the Greatest Money-Saving Section of this Conveyor

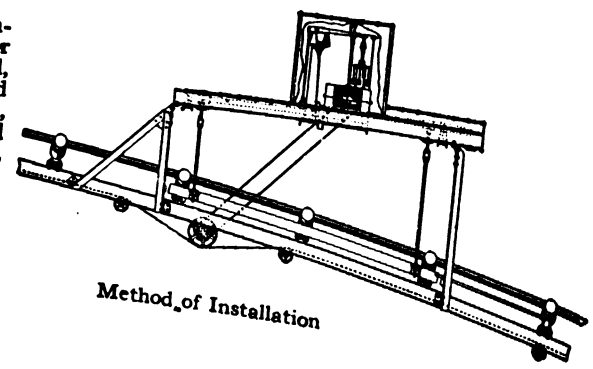
The Merrick Weightometer weighs all conveyor-handled materials ***while in transit*** and is ***guaranteed to be 99% accurate.***

No labor is required, as it weighs automatically and records the weight of the materials as they pass thru.

Send for the "Merrick Circulars," which contain graphic descriptions of the many types of installations. No obligation—glad to send them on request.

The MERRICK CONVEYER Weightometer

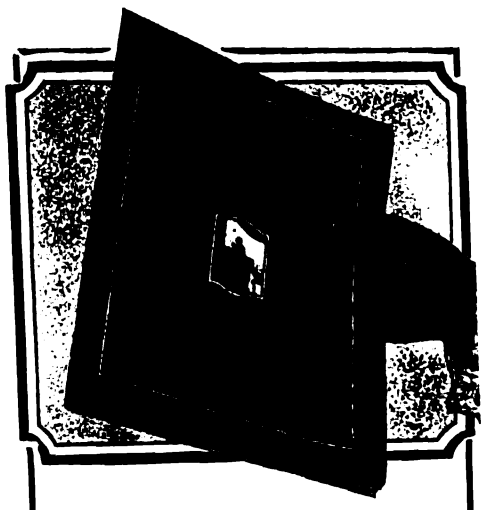
is in use in hundred of plants for weighing Coal, run o'mine and crushed; Coke, Stone, coarse and fine; Gravel, Sand, Cement Rock, Phosphate Rock, Phosphate Pebbles, Wood Chips, Sulphite Pulp Slabs, Fish and Fish Products, Ores, Etc.



Method of Installation

MERRICK SCALE MFG. CO.
180 Autumn St., Passaic, N. J.

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Here's a free book that may end furnace troubles

REFRACTORIES and Furnace Design is the title of this new furnace lining reference book. It gives information on weaknesses that have shortened furnace life, tells of troubles of the past. More important though, is the story that it tells of how modern monolithic construction with Plibrico Furnace lining corrects former furnace lining faults.

This book will tell how any man about the plant can install Plibrico to resist temperatures to 3100 deg. F—to cut down the loss of heat through the setting —to give two, three and even four years service without relining.

The knowledge gained from reading "Refractories and Furnace Design" may end the continual replacement of furnace linings that many engineers find necessary. Every operating man should read it and should keep it in his files for reference.

Do you want your copy of this treatise on the building of modern furnaces? There's no charge—no obligation. Just send the coupon. Your free copy will come by return mail.

Plibrico is delivered only in steel containers of distinctive appearance as shown below.

PLIBRICO FURNACE LINING
JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

Jointless Fire Brick Co., 1154 Clay St. Chicago.
Please send me the 32 page booklet "Refractories and Furnace Design"—no obligation.

Firm.....
Address.....
.....
Name.....
Position.....
Ind. Ill. 10-23

(*Continued from page 56*)

erly trained and inducted into the plant.

The Training Department instructors have a kindly feeling toward their trainees even after they are promoted into the plant; and through a follow-up system they keep track of and advise each individual until they know the pupil is full grown and needs no daddy to advise him.

The saying—"Once a teacher always a teacher" holds good with an instruction force, and after they have passed through the Training Department and learned the Instructors' Trade—even should they go back in the plant departments as foremen or forewomen, or to higher positions, they will always insist upon teaching others.

It takes between two and twenty years to learn to become a machinist, according to the different minds of men. The old method of tossing a boy into a machine shop to be battled about for at least the first year, being left to absorb what he can in the way of knowledge, and gain what he will in the way of experience, is a system which has been relegated to the scrap heap, and placed in the Hall of Fame as a practice of the dark ages.

Today a young man who is ambitious, willing and with a good imagination can readily learn in two years through proper instructional methods, the fundamentals of the machinist's trade. This has been proven by performance in a large number of city and corporation trade schools. In view of the above fact, is it not just for us to acknowledge that the same type of boy who has missed his opportunity and grown into manhood, can and should learn some special tool job in as relatively a short space of time?

When the above is accomplished, the result will immediately be of great benefit to machinists and tool makers already trained, for it is going to provide for them an opportunity to advance, through a promotion system of instruction, to better jobs and better pay, for we must acknowledge that there is plenty of room at the top. The plan as worked out by the Training Department at the W. R. A. Co.,

(*Continued on page 60*)

Not What We Say, But What Others Say About B.B. Service

"Referring to the foundry building you have completed for us, we desire to say, that the work has been done very satisfactorily and quickly. You have performed your part to our entire satisfaction and strictly in accordance with the specifications. We know we have a first class job in evary detail."





"In the completion of the Garage and Service Station, which you designed and recently completed, you have established a record in our community in the erection of our building both in speed and design. We desire to express our satisfaction with the result of your efforts and together with the community feel very proud of our building."

Catalog and other Testimonials on request

The BELING~BUSH CO., INC.
FACTORY ENGINEERS AND BUILDERS
Drexel Building Philadelphia Pa.

Rectigraph

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For Copying Machines
PRICES REVISED DOWNWARD

THE RECTIGRAPH COMPANY manufactures its own photographic copying machines and coats its own photographic paper, the entire plant being devoted exclusively to this line. Due to a lowering of the prices of some materials and economies effected in our new plant, we are enabled to announce normal prices on Photo-copying paper.

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REGULAR WEIGHT MATTE SURFACE Rolls 350 Feet Length		GLOSSY SURFACE Rolls 250 Feet Length.	
8½ inch width	$10.68	8½ inch width	$12.96
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13 " "	16.00	13 " "	21.68
14 " "	17.59	14 " "	23.36
15 " "	18.84	15 " "	25.04
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RECTIGRAPH emulsions are coated upon a high grade 100% rag stock, producing excellent results with a durable base. Rectigraph paper is a contrasty bromide paper, with excellent orthochromatic qualities, and will reproduce colors perfectly. All the speed consistent with good quality.

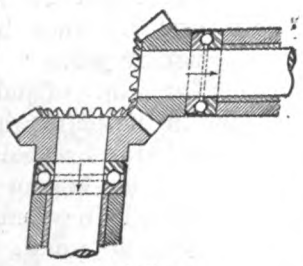
The RECTIGRAPH COMPANY has always regarded acceptance of an order as a pledge that it would be filled at the earliest possible date. The output of our plant belongs to our customers with orders on our books. This policy compelled us, during the past few years, to decline much desirable business which would have been highly appreciated, but this could not be considered without prejudice to previous connections. Improved facilities in our new plant enable us to increase production and quality and to decrease manufacturing costs. OUR CUSTOMERS WILL BENEFIT.

It is to your interest to become acquainted with Rectigraph Paper. We would be glad to receive your order for a sample roll, spooled to fit your photographic apparatus. You can then judge of its merits.

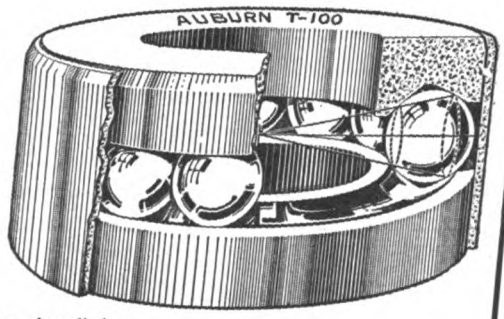
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BEVEL and HELICAL GEARS run better with AUBURN THRUSTS



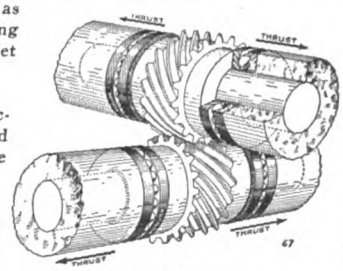
Bevel Gears



Auburn Ball Thrust Bearings when installed as shown keep Bevel Gears in proper mesh after long service, increase their life and assure more quiet operation.

Auburn End Thrusts, with their minimum of friction and wear, reduce the wear of other parts and insure a satisfactory performance of the whole machine.

Helical Gears operate with less power when Auburn Ball Thrust Bearings are used to take the end thrust as shown, by maintaining correct mesh of the gears throughout the life of the machine.



Helical Gears

Auburn Thrust Bearings or Collars when properly selected and correctly installed, maintain a uniform thickness due to their minimum of friction and wear, and thus reduce back lash and prolong the life of the gears. Send us particulars of your problem and let us aid you.

Steel, Brass and Bronze Balls

AUBURN BALL BEARING CO.

24 Elizabeth St., Trade Mark **Rochester, N. Y.**

Established 1893

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The Universal FLOORING for Modern Buildings

If you have in any office or industrial building a worn floor which needs renewing, the properties of Marbleloid fireproof flooring should interest you—because it is an ideal material for re-surfacing old floors whether they are wood or concrete.

This composition flooring is laid plastic over the old floor and in a few hours you have a strong, warm, smooth-surfaced, modern floor which adds much to the appearance, service ability and permanence of your building. This Marbleloid Floor will not dust or chip, will be found certain and elastic for walking and will not require any expensive upkeep.

We install each Marbleloid floor as well as manufacture the material and we will guarantee it to please you in attractiveness, longevity, warmth, strength and in all other qualities we claim for it. Let our engineers give you practical floor facts and send floor book. *Use handy coupon below.*

THE MARBLELOID CO., 467 Eighth Ave., N. Y.



THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building ..... below are the approximate areas involved.

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Our floors are
[ ] New Concrete [ ] Cement Finish [ ] Wood
[ ] Cracking [ ] Cold [ ] Slippery
[ ] Dusting [ ] Splintering [ ] Unsanitary
[ ] Noisy [ ] Rough [ ] Rotting

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Cuts the Cost of Reclaiming Coal

USED in conjunction with other equipment or used alone, the Scoop Conveyor is a mighty handy machine to have around for reclaiming or transferring coal from storage pile to boiler room.

It is ideal for loading small hand cars, electric dump trucks and similar equipment which in turn carry the coal into the boiler room. When the coal storage is not too far from the plant, two or more conveyors can be placed in tandem style, one feeding to another, and thus by feeding one machine the coal is delivered direct to the boiler room.

Well balanced construction permits extreme portability so that the machine can be easily moved about the yard.

Of course the same machine is used for unloading cars, storing coal and loading trucks or wagons. Any kind of coal, coke, ashes, sand, gravel, stone, etc., can be carried on the machine.

Thousands of users have found the Scoop Conveyor an extraordinary good investment.

Write for Catalog No. 158

Portable Machinery Co.,
PASSAIC, N. J.

ask any user

THE SCOOP CONVEYOR

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(Continued from page 58)

trained machine tool specialists as well as upgraded machinists and tool makers for higher positions. (See Fig 5.)

Observe any two men who are working together in a tool department of any large manufacturing concern. Johnson is forty-eight and Smith, thirty years of age. Johnson, the elder, is settled in his job as a tool maker; his bench is his horizon, he is a good, substantial workman, but has no ambition and lacks imagination; his week's pay and the little garden back of his house is all he ever expects to get out of life. He has a decent workman-like pride in his output, but his work consists in doing what he is told to do and being careful not to do too much, or to concern himself with matters that are outside of his special task.

Smith, the younger, finds himself assailed by doubts and fears; he cannot avoid thinking of the older man, and wondering if he is not likely to grow into the same condition of mind as the years roll by. Smith, the younger, does not like the prospect.

He has been studying nights, and would like to have some opportunity presented so he could train and advance beyond his particular job.

He wishes for a day of judgment to come in the plant when all minds would stand revealed, and everything be known by his employers so they might know what is on his mind. He quotes "what does it profit a man to become a better toolmaker than the rest?" He hopes that in some way the boss will find out what he wishes to do and open the way so that he can do it, but instead of that, what's on his mind is his own secret, and he feels that no one else will or can discover it. So his temptation is to settle back into his job and say to himself weakly "what's the use."

Such is not the condition in a plant operating a well thought out plan of training and upgrading mechanics. All that is necessary in order to gain advancement is to open the door and ask for the opportunity. The W. R. A. Co. upgraded machinists, tool makers and apprentices graduate to higher grade jobs such as blanking die makers, trimming die makers and die sinkers. There are a number of men now employed who were selected and given this opportunity to learn the higher class of work which brings them a higher wage. The places which were left vacant by these men had to be filled, and we therefore trained machine tool specialists as well as upgraded second and third class machinists, in order to fill in the gap left by those men who were advanced.

Training in industry need not necessarily be confined to the instruction of inexperienced people. Although this is perhaps its main object in busy times when help is scarce, the true measure of the value of such an undertaking is its worth during a period of years that represent a fair average of conditions.

Almost any manager, superintendent or foreman will admit that there may be some advantage in setting up a Training Department when that scheme offers the only

(Continued on page 62)



Eighty one tons of steel castings are stored on Lyon Standard Steel Shelving at the Brown, Lipe Gear Company, Syracuse, New York. Shelves carry a load of about 1500 pounds per bin. An excellent example of the great strength of Lyon Standard Steel Shelving.

Lyon Steel Shelving
—Endorsed by Industrial Leaders

TO be endorsed by the leaders of American Industry is the aspiration of many manufacturers — and the accomplishment of few.

For not many can meet consistently the rigid tests and exacting standards set up by those whose patronage is most sought for—not only because of its monetary value but also because of its prestige-building value.

It is a matter of pride to us that so many nationally prominent manufacturers have standardized on Lyon Steel Shelving.

But, to you, it is absolute assurance that you can depend always on the high quality of Lyon Steel Shelving and Lyon Service.

Perhaps our experience with the stores systems of so many large manufacturers may be helpful to you. If so, it is available to you without cost or obligation. Simply tell us you would like to have a Lyon Stores Engineer call on you.

Write us direct or the division nearest you. Your request will receive prompt attention.

Lyon Metallic Manufacturing Company
Aurora, Illinois

Boston, New York, Rochester, Philadelphia, Pittsburgh, Cleveland, Detroit, Los Angeles, Indianapolis, Chicago

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LYON STEEL PRODUCTS

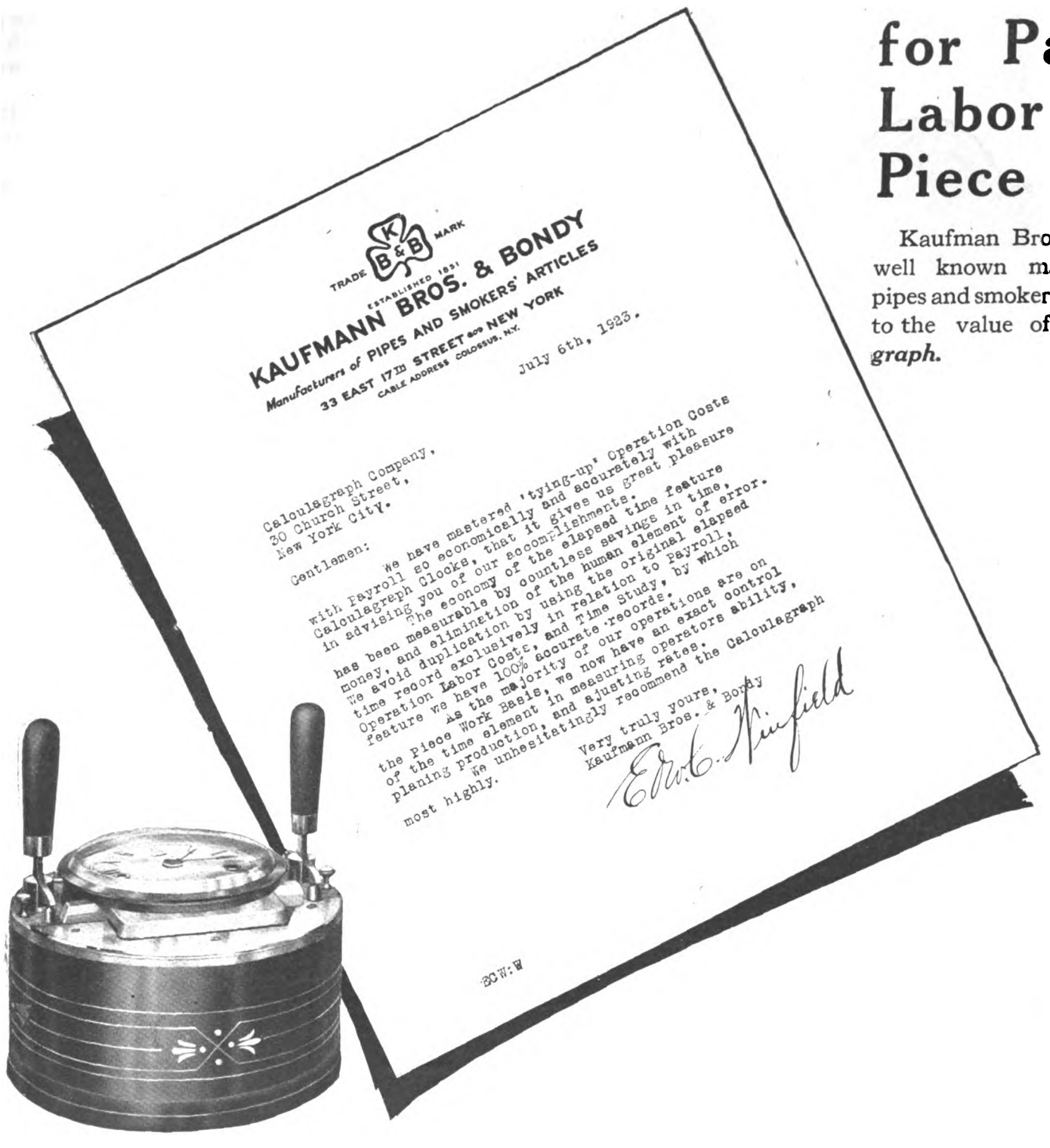


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CALCULAGRAPH
Elapsed Time Records



for Payrolls Labor Costs Piece Rates

Kaufman Bros. & Bondy, the well known manufacturers of pipes and smokers' articles, testify to the value of ***The Calculagraph.***

THE CALCULAGRAPH COMPANY

34 Church Street **New York**

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(*Continued from page 60*)

available means of obtaining more help, but naturally he wants to know what to do with the Training Department when the rush is over and help is more plentiful.

In most plants there are several grades of work, some comparatively simple and others more involved. Why not group machines doing the more simple work and route to them the same class of work they have been doing, using them as a starting point for beginners, then promoting them from this job to something more complicated, or to the same or more complicated class of work in the main shop?

The Training Department of the W. R. A. Co. has been run as a production factor from the outset. There are several distinct advantages to be gained thereby.

First, it avoids the scare which the trainee frequently undergoes when he is "pitchforked" into the plant from the street.

Then again many employers have in their plants men who are willing workers and who maintain the proper mental attitude toward the employer, but whose efficiency falls somewhat short of the desired degree. The employer hesitates to discharge such a man and yet he feels that there is some doubt as to the advisability of keeping him. His problem in such a case is a serious one. It could be solved by placing such a man in the Training Department for a brief period until he has made suitable proficiency in his work. Both employer and employee would greatly benefit thereby.

Why is it that we take it for granted that everybody except ourselves need training?

Human labor is the most important single factor in our business lives. Why do we agree that fighters, racers, doctors, lawyers, engineers need training, and yet do not give our own shop boys the same chance to become expert in accuracy and speed?

In what other desirable way will you obtain *permanent lower costs?*

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

MAKING THE EQUIPMENT FIT THE JOB

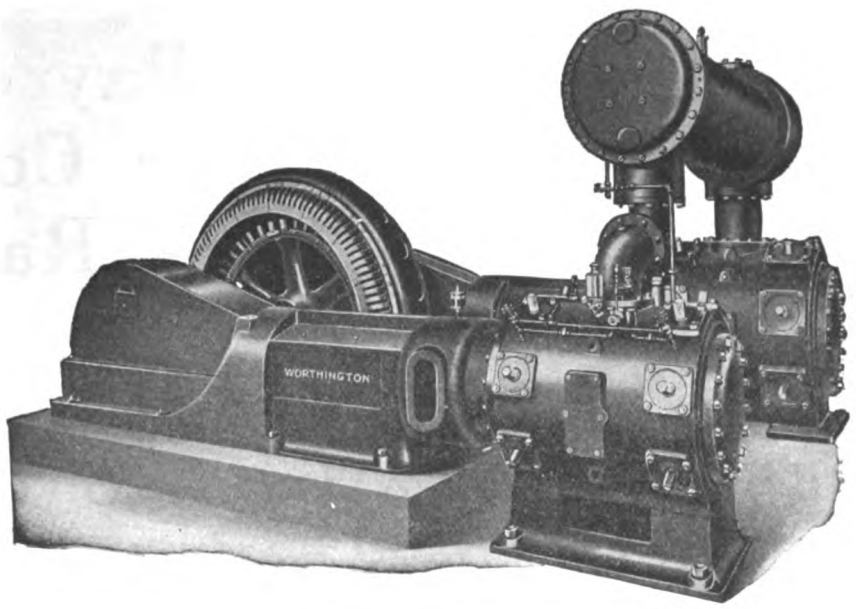
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670,000 HORSEPOWER OF ELECTRIC HEAT

General Electric Co.



. . . So They Asked FEATHER (Reg. U. S. Pat. Off.) Valve Owners

The Brooks Callaway Co., of Atlanta, Georgia, wanted an air compressor. They telegraphed several firms who had used Worthington FEATHER Valve Compressors and asked these users what they thought of their machines.

Here are the Replies:

We have two Laidlaw Feather Valve Compressors which are giving perfect satisfaction.

Concerning your wire of the twentieth, we have two Laidlaw Feather Valve Air Compressors manufactured by Worthington Company in service for two years which have given entire satisfaction.

We have 3,000 feet Laidlaw Feather Valve Compressors; three purchased 1915, three purchased 1920. Service exceptionally favorable. Maintenance very low. Efficiency very good.

We are using Feather Valve Compressors for air and amonia and giving repeat orders. We know of nothing better for a valve. The details of the rest of the machine should vary according to your particular service and price you wish to pay.

We have one 800 cubic foot steam-driven Feather Valve Compressor and one 3,000 cubic foot motor-driven compressor, operating at 120 pounds period with our conditions. Both machines operate very satisfactory.

Your telegram June 20th. We have found Laidlaw Feather Valve Compressor quite satisfactory and can recommend it.

Our operating experience with Laidlaw Air Compressors satisfactory.

Eleven Laidlaw Feather Valve Compressors has been generally satisfactory on this work for three years.

Our experience with Laidlaw Compressors and Worthington Pump and Machinery Company have been most satisfactory. Have nothing unfavorable to report.

Names of senders furnished upon request

WORTHINGTON PUMP AND MACHINERY CORPORATION
Executive Offices: 115 Broadway, New York City. Branch Offices in 24 Large Cities

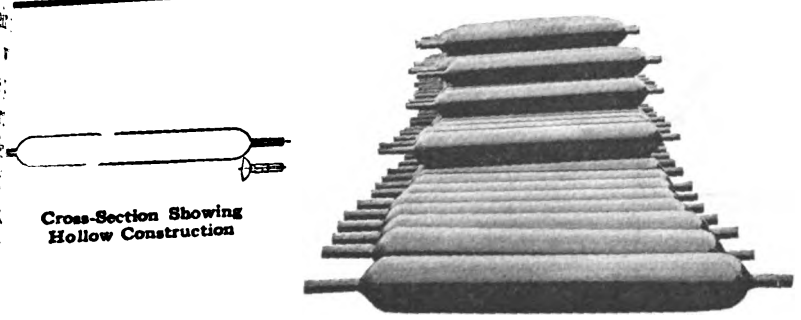
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WORTHINGTON

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works *East Cambridge, Mass.*
Worthington Works *Harrison, N. J.*
Laidlaw Works, *Cincinnati, Ohio.*
Hazleton Works, *Hazleton, Pa.*
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Cross-Section Showing Hollow Construction

SEAMLESS DRAWN STEEL HOLLOW ROLLS

For Conveying Systems, Steel Mill Tables etc.

Because these rolls are light in weight they possess these specific virtues:

There is a saving in freight
They are easy to handle
Operating and power costs are reduced

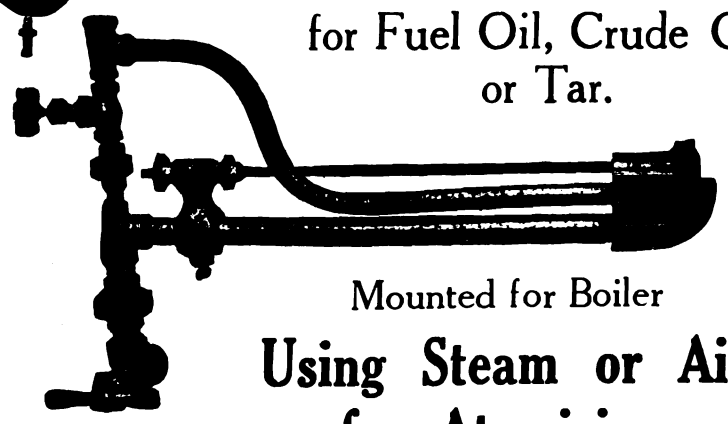
Built only on order to meet customers requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.

Wm. Wharton, Jr. & Co., Inc.
(Founded 1859)
30 Church Street, New York, U. S. A.
Cable address—Wilwharton

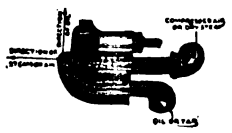
CALOREX Burners

for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



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Unmounted

Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing.* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

Write for catalog.

W. N. BEST FURNACE & BURNER COMPANY
11 Broadway ENGINEERS IN CALORIC **NEW YORK**
There is nothing better than the Best



How Much Do Your Office Partitions Cost Yearly?

OFFICE space is costly. It averages from $2 to $3 per square foot. How much of this valuable space do your partitions needlessly occupy?

When Globe-Wernicke Counter Height Filing Cabinets are used there is no wastage.

These cabinets serve two purposes—each more efficient than the equipment they replace. They form a handsome counter of generous size and serve as partitions between departments.

Files for Globe-Wernicke Counter Height Cabinets may be obtained for any purpose—for correspondence files, card index, catalog, reference shelves or roller shelves for heavy books.

With Globe-Wernicke Counter Height Filing Cabinets there is the least possible amount of lost motion. The clerk remains right at the counter, selects from the files what he desires and uses the top as a table.

Save valuable space and increase your efficiency with Globe-Wernicke Counter Height Filing Cabinets.

Obtainable in either wood or steel of the desired finish.

The Globe-Wernicke Co.
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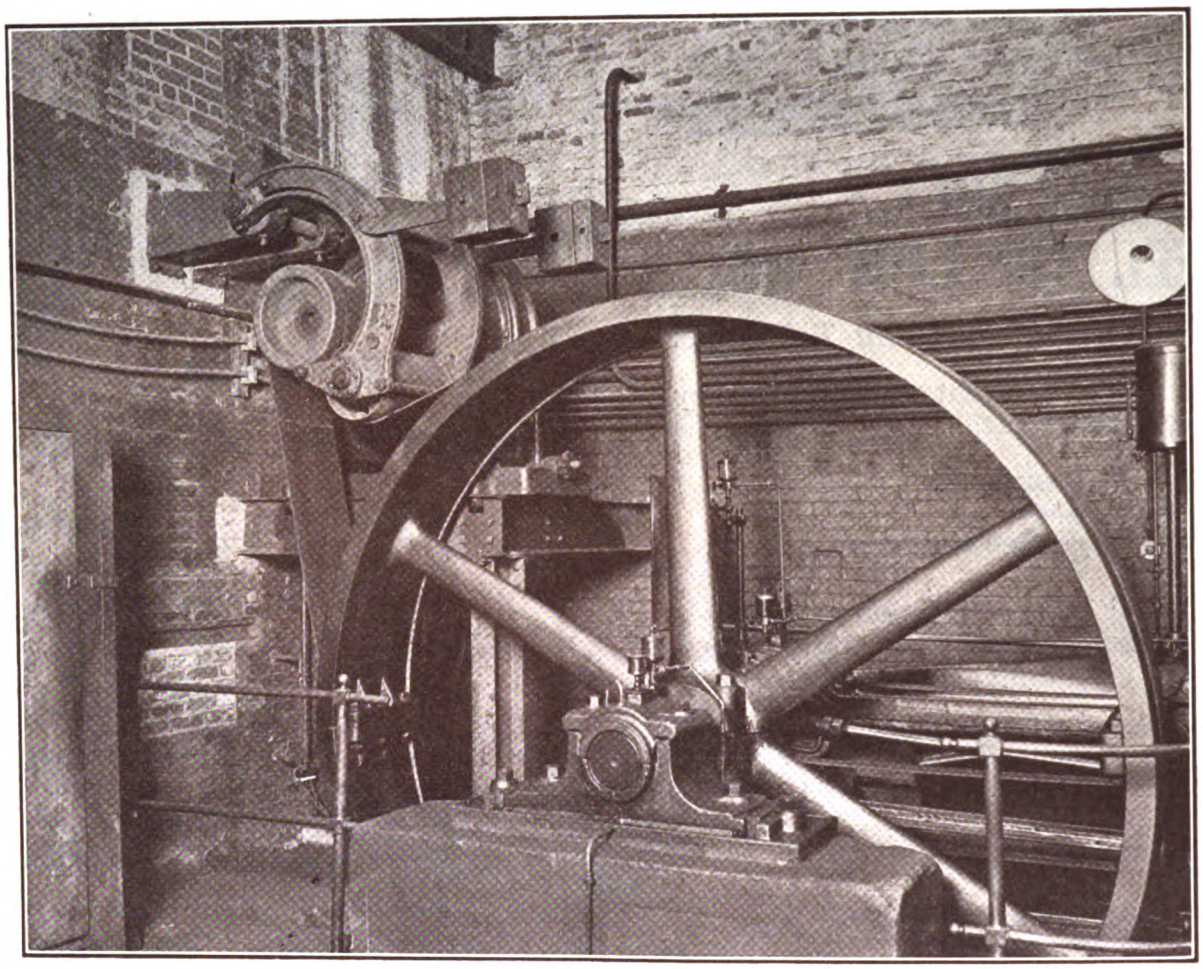
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THE LENIX DRIVE



Point Number Three—"Saving Floor Space"

The installation illustrated speaks for itself.

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

This 90 KW Alternator is mounted on a platform back of the steam engine fly wheel. The actual pulley centers are only 7'-6". The horizontal pulley centers are but 6 feet.

This alternator was originally mounted on the floor in what would be the foreground of the photograph, were we to show its original location. The patches in the brick wall above and below the Lenix show where the belt passed through the wall to a lineshaft in the next room. From the lineshaft the belt again passed through the wall to the alternator pulley. The alternator is now practically "hung on the wall," and the engine room floor is free of the alternator as well as of the rapidly moving belt, which formerly crossed it.

This installation could not be operated without the Lenix drive, and it is one of the many where the absolute freedom in pulley locations permitted by the Lenix is saving floor space—and belting.

Booklet: "Saving Slippage and Space" tells how it is done. Write for a copy.

F. L. SMIDTH & CO.

ENGINEERS

50 Church Street New York, N. Y.

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The Petroleum Industry in California

(Continued from page 26)

this organization. Capital was provided for the construction of pipe lines to transport the crude from the fields to tidewater near San Francisco Bay. A little later, as other companies grew up in the State, new markets were discovered and refineries were erected.

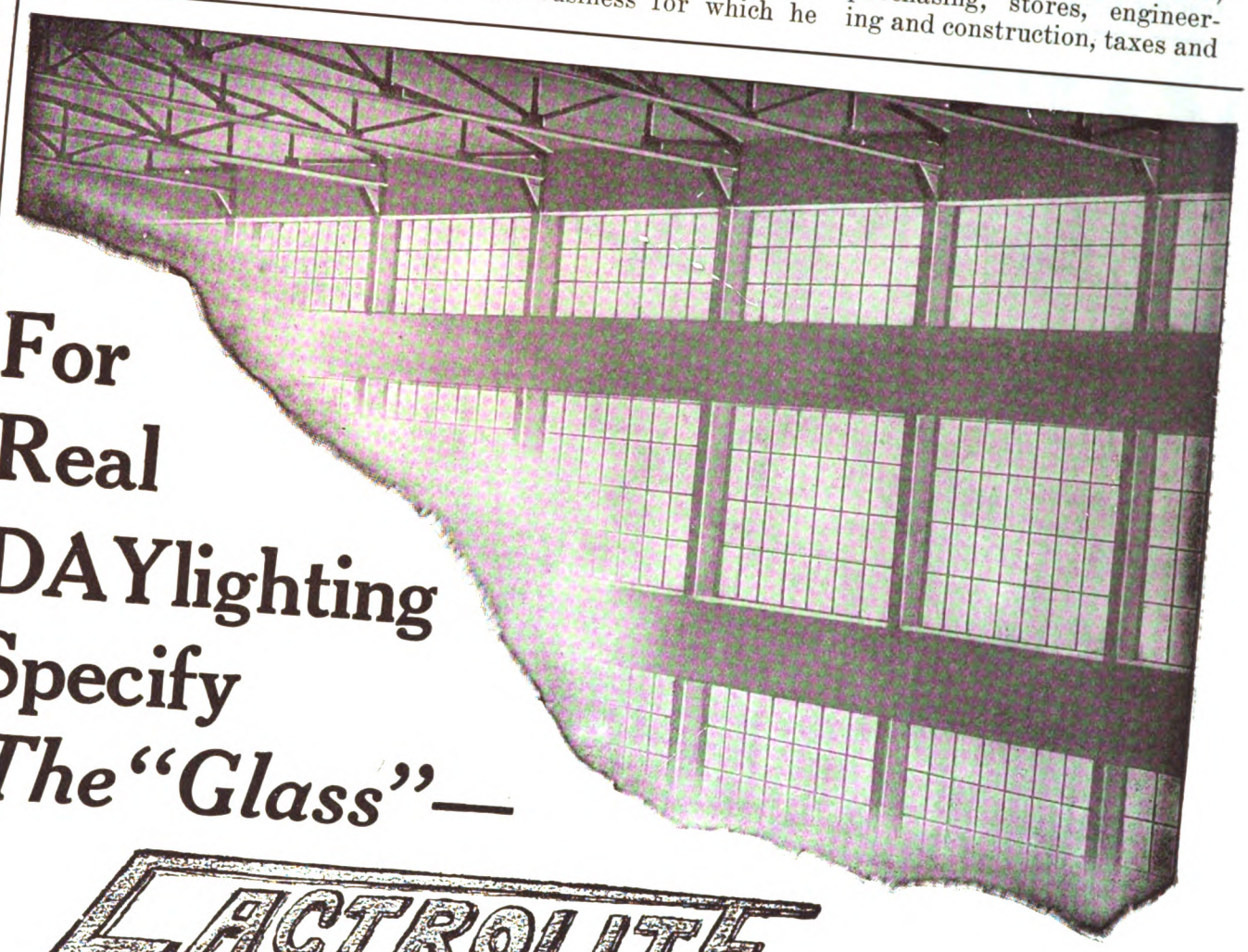
In many respects, the situation in Kern River in 1901 duplicates the over-production which followed competitive drilling of offset wells in the fields adjacent to Los Angeles. Much of this territory was held in small lots. Drilling was rushed for the purpose of developing and producing the oil which the operator knew would stay beneath his own property only as long as there was no well drilled near enough to his boundary line to cause the oil to migrate into the competitor's territory. Intensive drilling caused everyone to abandon the economic principle of leaving a fair proportion of recoverable oil in underground storage until the maximum profit can be obtained, and then bringing the oil to the surface by drilling wells spaced a maximum distance apart in order to secure the subterranean supply.

Where drilling takes place in congested areas, there is not enough oil underground, even in the richest districts, to yield a satisfactory profit for everyone when the cost of all the wells is considered. It must be remembered that even in ordinary times, drilling an oil well under conditions such as obtain in these fields, costs from $40,000 to $100,000, or more. Under conditions such as obtain in Southern California today, where labor and materials have been greatly advanced in cost, the total investment is unusually large.

It will help to make clear just what the contribution of the large corporations has been if we consider the type of organization necessary to control a typical "four-cycle" company engaged in all phases of the industry. Such an organization consists of a Board of Directors directly responsible to the stockholders. Under the supervision of the Directors' Executive Committee are the usual corporation offices, consisting of President, Vice-Presidents, General Manager, Treasurer and Auditor. Each of the four or five leading divisions of the industry will have its Manager or Superintendent. Thus, there will be one official in charge of the producing fields, another supervising the operation of the pipe lines, a superintendent of refineries, a head of marine transportation, and a sales manager.

Each of these executives builds up an organization adapted to the particular phase of the business for which he is responsible.

In addition to these large operating divisions, most of the oil companies in California maintain functionalized staff departments in charge of geology, marine transportation, purchasing, stores, engineering and construction, taxes and



For Real DAYlighting Specify The "Glass"—

FACTROLITE

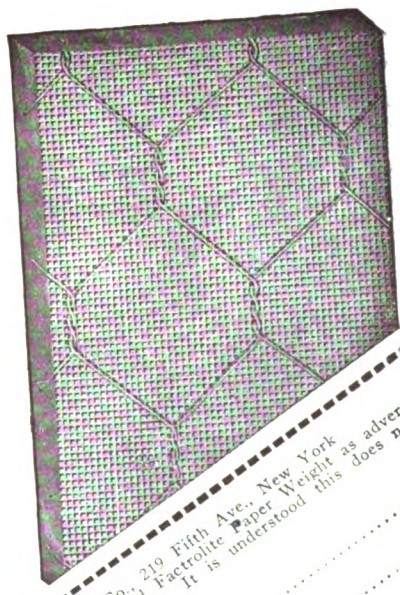
By **reflection** from the plane surface of ordinary glass a great deal of daylight is lost. The prismatic surface of FACTROLITE **GATHERS** these daylight rays that are ordinarily lost (particularly in confined locations where light strikes the panes at a narrow angle) and **diffuses** them indoors.

When direct sunshine strikes on windows glazed with "FACTROLITE," the workers do not have to work in a blinding glare or to hang blankets or shades to check the sunlight. FACTROLITE gives perfect diffusion that eases eye strain on the workers nearest the glass and gives those deep in the building interior a clear **diffused** daylight to work in.

The U. S. Government recently used over 100,000 square feet of "FACTROLITE" for daylighting a huge building 300 ft. x 700 ft. The engineers tell us that you cannot see a shadow in any part of the big structure.

FACTROLITE is made both in plain and wire glass. Test FACTROLITE in your own laboratory. **A free sample will be sent to engineers who use the coupon.**

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Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way.

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claims, and personnel. Separate departments may also be organized to take care of the telephone and telegraph system, legal matters, and statistics. The extremely important part played in the oil industry by such service and accounting departments is demonstrated by the fact that three of the leading companies of the state have recently erected very extensive buildings to house their general office staffs.

Organization growth has been directly affected by the pioneering nature of the industry. For example, many persons understand the contribution made by the geologist in locating new territory, but comparatively few appreciate the part which he plays in devising and improving methods of field operation. In California, the State Bureau of Mines and Oil maintains a staff of geologists and engineers who have contributed a great deal toward preventing the encroachment of water upon the oil sands. Their advice to the small operators having no geological departments, has proven especially valuable.

Some conception of what has been accomplished by the geologists of individual corporations may be gained from experience in the Kern River field. Nearly a million dollars were spent in that territory between 1915 and 1923 in an effort to shut off water flooding the oil measures. There are 2,170 producing wells in this territory. By carefully studying the drilling history and all subsequent work done on these wells, data was collected which made it possible to recommend a variety of corrective methods. The net result was a reduction of 1,575,800 barrels in the amount of water produced each month; that is, from 4,665,300 barrels to 3,089,500 barrels. In addition to reducing the water pumped by approximately 34%, the rate of decline in the production of crude oil was definitely checked, several properties showing practically no decline of production during the last three years of stable operating conditions.

No new well is drilled today by any large company without a very complete record being made of every formation through which the drill passes, and of all work of any kind done in the well subsequent to its completion. The geological departments maintain thorough records of every field, thus making corrective recommendations possible, which under the old unscientific method of operating without engineers or geologists, would have been entirely overlooked.

Both chemists and petroleum engineers have made strides tremendously significant to the industry. Nearly every large refinery now has connected with it a control and research laboratory. Several of these are well equipped with motor testing departments, where both fuels and lubricants can be tried out under actual operating conditions. In every division of the industry, well trained technical men, possessed of originality and courage, are at work on serious problems.

How far the experts have already gone in solving serious problems, how successfully the work is being attacked, may be

(Continued on page 68)

MAKE Him Understand
Say it with a Fence



HIGH,' unclimbable, and impregnable, an Anchor Post Chain Link Fence will enforce respect for your property rights.

It will prevent dumping on your grounds and afford protection against sneak thief, night prowler, troublemaker, and other dangerous trespassers.

Ruggedly constructed throughout. Fabric of heavy steel wire, No. 6 gauge. *Drive-Anchored* Steel Posts keep the fence in constant alignment. Every part *thoroughly galvanized* to resist rust.

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FIRM *~because anchored*
PERMANENT *~because galvanized*

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Made for maximum service not merely the average

TRADE JENKINS MARK

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Safe in Severe Service

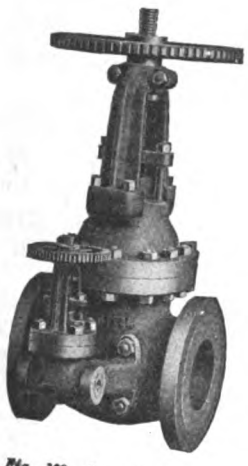


Fig. 189, flanged, Extra Heavy Cast Steel Gate Valve with By-Pass.

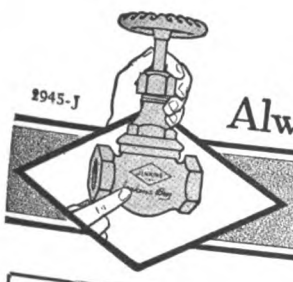
JENKINS Extra Heavy Cast Steel Valves handle superheated steam and high pressures with great safety. Every feature of their design has been carefully studied to produce easy curves and uniform thickness of metal in their bodies and bonnets. They are heavy, flawless castings having enormous strength and rigidity.

Where pressures and temperatures are high—where service is severe—they are absolutely reliable, perfect working valves.

Valves in bronze, iron, and steel for all requirements. At supply houses everywhere.

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Always marked with the "Diamond"

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SINCE 1864

THE TOWMOTOR VS THE LABOR SHORTAGE

CARNEGIE STEEL COMPANY

PAINTER MILLS

PITTSBURGH, PA. April 28th, 1923

The Towmotor Company
1226 East 152nd Street,
Cleveland, Ohio.

Attention Mr. F. W. Sears.

Gentlemen:

Replying to your letter of the 26th inst., beg to say that I am firm in the belief that there is a large undeveloped field for industrial tractors.

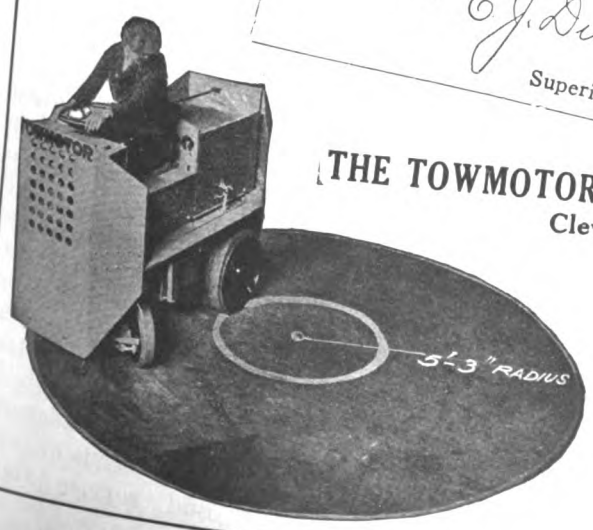
We are using two Towmotors in our hardest service in hauling steel from our yard to the Mills, over paved and dirt roads, and on an 8% grade.

This method is more satisfactory and much more economical than our former practice of teaming.

Very truly yours,

Signed: E. J. Dittmar

Superintendent.



THE TOWMOTOR COMPANY
Cleveland, Ohio



Right in Your Own Hands

—to examine—to pull the broom corn aside and see for yourself the tough strong center and evenly distributed fibres that give the Lay Metal Case Broom its long life in super-service. Test for yourself how firmly each fibre is held in the vice-like grip of staples—not nails—driven and clinched on both sides. See how perfect the balance, how sturdy the construction, and how flexible the extra wide sweeping tip.

And besides, our policy is to make brooms especially built for the different work demanded by different industries,—a textile broom for the textile industry, another type for the steel industry, another for the woodworking shops, etc. There is a design to do your job best; let us show it to you.

We are willing to pay all the costs of your test. If our brooms can't do your job better than any you have ever used, return our sample at our expense.

The Joseph Lay Company, Inc.

Ridgeville 120 College Street Indiana

Originators of the Metal Case Broom

Just send in this coupon showing your name, the kind of floors in your plant and the type of refuse our broom will have to handle.

Name .....

Address .....

Our floors are made of wood.....cement.....earth.....

and brooms would have to handle.....

We need special brushes for.....



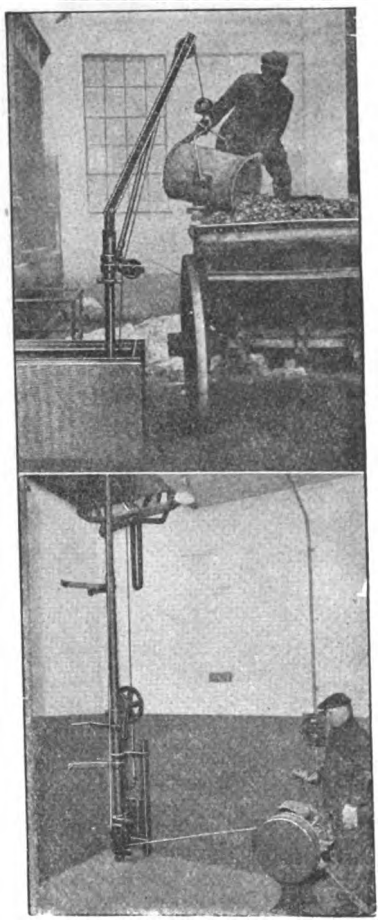
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In Factories, and large buildings where boiler room is below grade level—

The G&G ELECTRIC REG. U.S. PAT. OFF.

Telescopic Hoist



Model D Electric G&G Telescopic Hoist at Mergenthaler-Linotype Co., Brooklyn, N. Y. Test showed 78 cans of ashes raised and lowered in 1 k. w. h.



Model E Electric G&G Telescopic Hoist in use at New York Telephone Co., (main building) Brooklyn, N. Y. Raises ashes at rate of 15½ tons in 1 k. w. h.

Offers the most dependable and most economical method for removing ashes.

DEPENDABILITY:

At the Albany High School, Albany, N. Y. a G & G Model C Electric Hoist has been in continuous use since 1913 and has met every emergency due to severe weather conditions during this long period.

DURABILITY:

At the Finance Building, Philadelphia, a G&G Model D Electric Hoist has been in continual use in this large office building for 8 years. Distance of lift is exceptional, being 48 ft. from boiler floor to grade.

FLEXIBILITY:

At the Hotel Grand, New York, a G&G Model E Electric Hoist raised 3500 cans of ashes in one continuous operation, the accumulation following a severe blizzard. The average daily ash removal is only about 35 cans.

ECONOMY:

At the main Long Island building of the New York Telephone Co., Brooklyn, N. Y., a G&G Model E Electric Hoist was recently tested for current consumption. Test showed that ashes are raised at the rate of 15½ tons (296) cans in 1 k.w.h. costing $.0348 or 85 round trips for one cent. The Bell Telephone System uses 86 G&G Hoists in its various buildings.

These are only a few instances of G&G ash removal performance. G&G Hoists are made in various models to meet the needs of all kinds of buildings.

For instance, G&G Ash Removal Equipment is in use in 626 industrial buildings, 604 office buildings, etc.

Write for illustrated Booklet No. 190

GILLIS & GEOGHEGAN

556 West Broadway New York

(Continued from page 66)

judged from reviewing a few of the outstanding developments of the past few years in the California fields.

In oil production, the most noteworthy development has taken place in drilling methods, where the rotary has largely supplanted cable tools. A few years ago, it was customary to drill wells almost entirely with standard or cable tools. The method of operation was by a power-driven walking beam, consisting of a heavy timber working on an axis. As the walking beam rocks up and down with a stroke of three or four feet, it raises and lowers the string of tools, their great weight giving them a striking force equal to that of a steam hammer.

The newer rotary system uses a perforated fish tail bit attached to a string of drill pipe, which passes up through the derrick platform. The top joint of the pipe is rotated by a turn-table at the rate of about 200 revolutions per minute. A swivel connection at the top of the drill pipe is attached to a hose, through which thin mud is pumped to the bottom of the hole. As the mud circulates, it carries out the cuttings made by the fish tail bit, and also serves to wall up the inside of the hole as drilling progresses. The hydrostatic pressure prevents caving of loose formations, thus making it unnecessary to use any casing until the hole is finished.

During the last three or four years, many improvements have been made in drilling equipment with the result that the rotary method is now almost universally applied in the California fields, the standard tools being used only in uncertain formations, or to complete a hole where conditions obtain which render the use of a rotary impractical.

An equally significant evolution has been taking place in pumping equipment. A few years ago, oil-fired boilers furnishing steam were almost universal well pumping equipment. On cold mornings, the steam rising from hundreds of wells was a characteristic sight in every oil field. Now, electrically driven motors and gasoline engines are the rule.

Wherever surface conditions and the location of wells will permit, jack plants are being installed. These are usually motor-driven, a forty horsepower, constant speed motor being widely utilized. By an arrangement of belts, countershafts and eccentrics, the pumps are operated by means of cables. In the installation of the plant, care is taken to balance the wells on one side of the plant with those on the other side, so that the pull on the eccentric is approximately equal in every direction.

The following figures show the comparative costs of operating individual motors and jack plants. The operating costs are averages taken for a large number of wells:

	Cost of Installing	Operating Cost (per well per month)
Jack Plant (25 wells)	$10,000	$10.00
Individual Motor	1,900	30.00
Gas Engine	1,900	60.00

Oil transportation methods have been developed along lines entirely separate from those used in transporting other kinds of merchandise. The necessity of moving tremendous quantities of a bulky liquid, some of the products being highly inflammable, and all capable of causing considerable damage to other commodities or of being seriously injured themselves by improper handling, have brought about the invention of a variety of unique methods.

The first extensive pipe lines were built in California in 1908, and the State now has in operation over 1,750 miles of line, the major part of which lies in the San Joaquin Valley and in the oil fields of Southern California adjacent to Los Angeles. The development of the electric welding process has made it possible to lay line much more rapidly and permanently than was possible a few years ago.

To surmount sales transportation difficulties, numerous special devices for the rapid transportation and safe storage of oil have been originated. Particular attention has been paid by construction engineers to the problem of preventing fires and explosions due to static electricity, in trucking and handling petroleum products. Special devices have been perfected to protect trucks both in operation and while being filled with inflammable products. All parts of storage plants and service stations

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where fires may arise from this cause are being bonded with heavy copper wires to enable static accumulations to be carried off to the ground.

California now has fifty-four refineries with a daily capacity of 400,000 bbls. of crude. Several new refineries of large capacity are being erected not far from Los Angeles. The insistent demands of the motor driving public for gasoline have completely revolutionized refining methods. Only a few years ago, gasoline was the least valuable of several refinery products. Until the last few months, every energy was being bent to supplying it in greater quantities. Four means are being used to secure a greater yield of gasoline from crude oil: first, blending the highly volatile natural-gas gasoline, or "casinghead," with less volatile refinery products; second, breaking up or "cracking" the lower gravity distillates, such as distillate fuel oil, to increase the yield of gasoline; third, general improvement in refinery efficiency; fourth, producing a gasoline of somewhat lower volatility, but well adapted for use in the average motor.

Due to the tremendous increase in production of high gravity crudes in the Southern California fields, the demand for increased yields of gasoline is not as keen as it was a few months ago. The State Oil and Gas Supervisor estimates that in 1922, California's production of crude above 20° Baumé almost equalled the entire 1920 production of crude oil of all grades, which was 105,700,000 barrels.

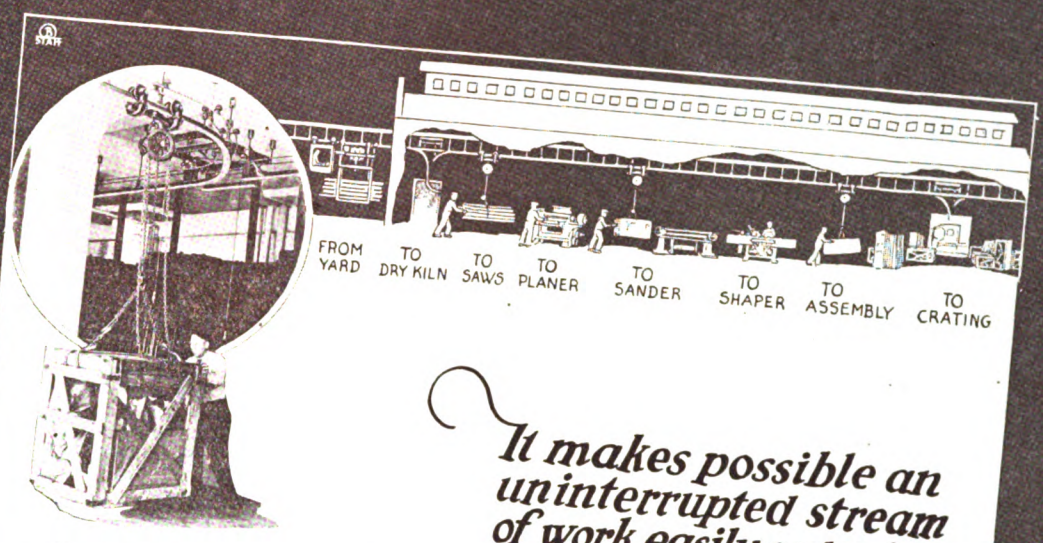
In March, 1923, it was estimated that the total daily production of gas in California was 580,000,000 cubic feet. Of this immense quantity, 275,000,000 cubic feet were said to be blowing into the air. Perhaps the greatest waste at the time was in the Long Beach oil fields where about 190,000,000 cubic feet roared into the air daily. This represents a daily loss of approximately 190,000 gallons of gasoline, since the gas in that field yields in the neighborhood of one gallon of natural-gas gasoline to each thousand cubic feet of gas.

No more striking developments have taken place in the industry in the last decade than in the recovery of natural, or casinghead, gasoline. Of all the gasoline manufactured last year in the United States, nearly 10% is estimated to have been casinghead gasoline. In 1922, California produced 693,497,000 gallons of motor gasoline and 53,707,000 gallons of "casinghead." About half of this natural gasoline is combined with crude oil and run into the pipe lines, thus losing its identity, while the remainder is used for blending and other purposes in its natural state.

Much interest has lately been attracted by the so-called "Jitney-Unit" extraction plants, making use of the Newton process. These plants vary in size from a capacity of 50,000 cubic feet of gas daily up to 3,000,000 cubic feet capacity. A plant of the larger size can be erected for $25,000. Operation is said to be so nearly automatic that a small plant can be run in spare time by the regular pumpers on the oil lease.

As the demand for economy

(*Continued on page 71*)



From rough lumber storage through every department and to every machine in the mill—even to the loading of finished material on to trucks or cars—***the Cleveland Tramrail can be arranged to save thousands of dollars yearly in material handling costs.***

Besides saving man power and labor—it speeds up the movement of lumber from one machine or department to another.

It makes possible an uninterrupted stream of work easily and quickly handled between every operation in the Wood Working Shop

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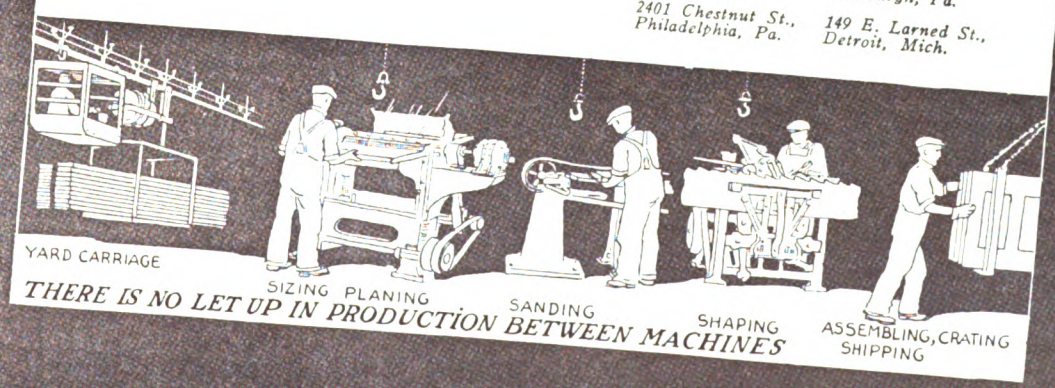
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THERE IS NO LET UP IN PRODUCTION BETWEEN MACHINES

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The Cutting-off tool on an automatic screw machine

and

ROOT



The Root Co.,
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The Scorekeeper

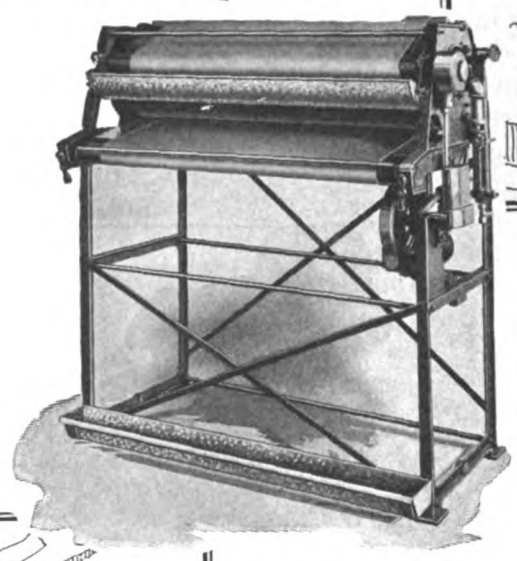
The Screw machine turns 'em out fast but not too fast for the ROOT Counter. Every piece is registered; and the total is accurate. We will gladly tell you about other applications of ROOT Counters

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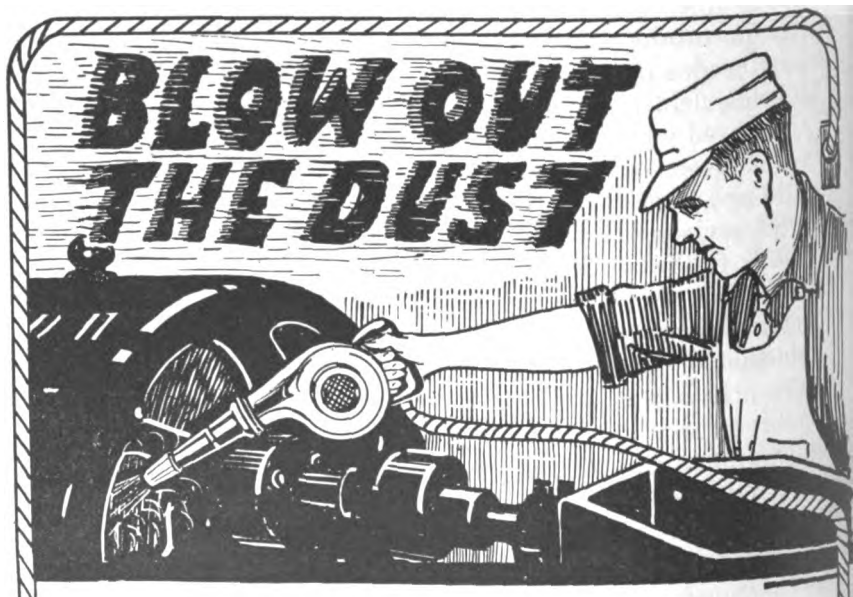
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The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc.

Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

Weighs only 6 lbs. Complete in itself and requires no expensive installation or equipment. No condensation as with compressed air. Attached to any light socket.

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(Continued from page 69)

in operations becomes more insistent, and as the industry becomes constantly better developed and better organized, it is nearly impossible to operate a successful refinery without producing lubricating oils, greases and other by-products. The economic condition developed in 1920, where all of the gasoline and most of the kerosene were necessary to support the cost of crude oil, left little or no margin of profit for plants not making lubricating oils. The differential in favor of the all-around refinery is said to be gradually increasing. Certain oil economists are of the opinion that within a very few years there will be widespread failures of refineries running domestic crudes which are inadequately equipped for extracting a majority of the various useful products from their raw material.

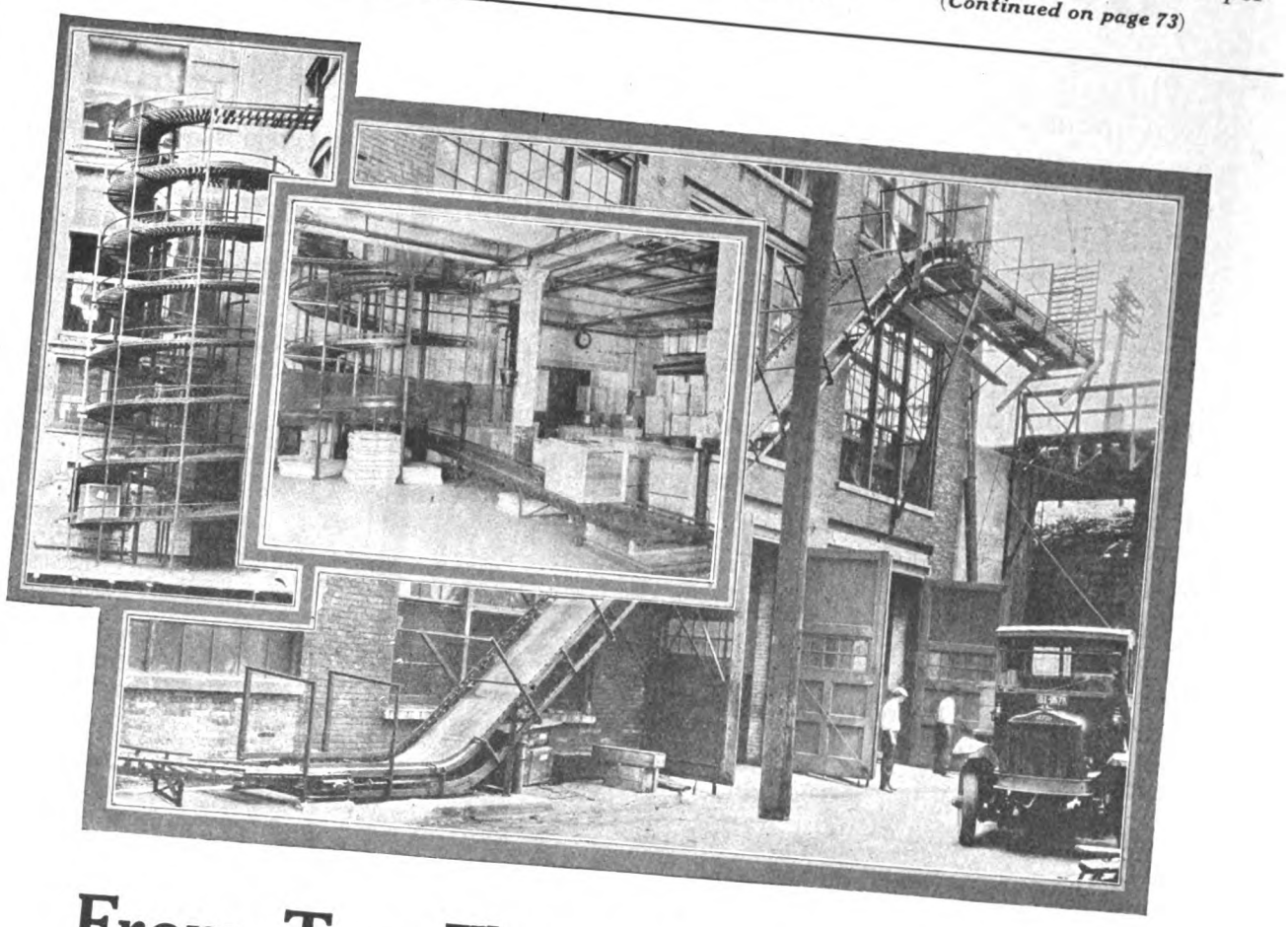
Over-production in recent months has led to an enormous increase in the available storage facilities. Hundreds of steel tanks and scores of huge cement reservoirs are being erected, and long disused storage has been filled to capacity. The total crude oil storage capacity of the State is now estimated at 85,000,000 barrels. On May 1, 1923, about 70,000,000 barrels were in storage.

One of the problems facing the oil industry at the present time is the serious losses which must of course be counted upon in this tremendous quantity of stored oil during the hot summer months of 1923. With volatile oils the loss is much greater than with heavy crudes, so the tendency has been to ship the lighter crudes to the eastern refiners, keeping in storage only the heavier petroleum which will suffer less waste through evaporation.

It is well worth noticing in passing that the growth in both the refining and production of oil in the State has necessitated the erection of numerous branch factories for the manufacture of machinery and equipment for Pacific Coast needs. Both Los Angeles and the San Francisco Bay district have profited by this growing tendency on the part of eastern manufacturers.

The oil tanker, always an important factor in the industry, is essential to operation in California. Producers ship oil up and down the Pacific Coast by this means and engage in extensive trade with the Pacific Islands and the Orient. More recently, the oil tanker has been the salvation of the industry in Southern California, making it possible to send shipments East to supply the demand created by the diminution in Mexican production. Tolls from Southland oil shipments in the twelve months ending May 1, 1923, equalled about two-thirds of the Panama Canal's entire income for 1922. In the four months ending April 30, 1923, shipments from Los Angeles passing through the Canal aggregated 13,346,000 barrels of oil. During April and May, 1923, shipments to Gulf and Atlantic ports of the United States averaged over 1,200,000 barrels of crude and fuel oil per week. The same period saw a weekly export to foreign ports averaging 360,000 barrels per

(Continued on page 73)



From Top Floor—to the Cars —with Savings at Every Step

CAN you picture a smooth, convenient flow of products through your plant without a lost moment in transportation, or any manual labor except for loading and unloading? That's what this Mathews Conveying System has done for the Burson Knitting Company of Rockford, Illinois. Mathews Carriers have eliminated all handling of goods by slow elevators, truckers and trucks, from the time boxes leave the packing room on the fourth floor, until they are stored in a freight car ready to ship. At every step in this installation a definite saving was made, both in handling time and in cost of trucks and labor.

Boxes open on two sides, ride with absolute safety on the spiral conveyer—centrifugal force and specially made double rollers keep them in perfect position. In the packing room Mathews equipment has added another point to economy. The open boxes can be closed, weighed and marked without removing from the conveyer. Some boxes are put away for stock, the rest are caught by the push-bar elevator outside the building and deposited on a freight car on the elevated siding above. Previously, a five-ton truck had to carry the shipping cases several blocks to a loading station.

Your handling problem may be simpler, or perhaps a great deal more complicated. But Mathews equipment can save for you as it did for the Burson Knitting Company, not only in speeding up material handling but in cutting many dollars from the pay-roll.

Apply these facts to your handling problem. Is there a place in your factory where Mathews conveyors could solve a similar problem for you and add many dollars to your profits? A Mathews man will gladly consult with you, or, if you wish, a catalog showing types of equipment adapted to every use will be sent you. A letter gives you prompt attention.

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It Can't Air-Bind!

When steam is shut off the Steam Trap Sarco opens automatically and stays open until steam is again applied—then the steam forces all the air out and closes the trap until condensation again opens it. No air or water can stay in the trap.

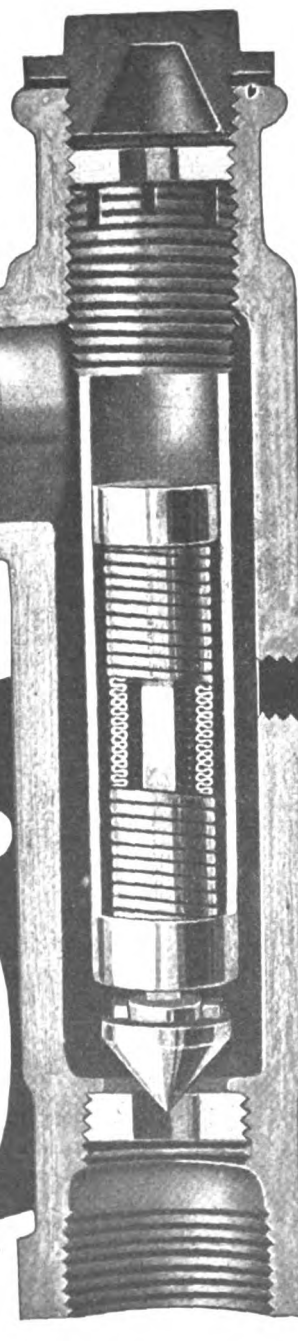
Consequently the Sarco cannot freeze.

Steam trap Sarco keeps the lines drained at all times. There is no big body of water in the trap to cool the steam and reduce it to liquid.

Has only one moving part. No levers, gauges, stuffing box, etc., to corrode or gum up and stick, and cause the trap to stay open and waste steam.

Can be screwed into pipe line at any angle and takes practically no space. No platform, pit or support needed.

Although the Sarco has many exclusive advantages, it costs but one-third the price of most traps.



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And Here are the Reasons

Utica — Non-shrinking tool steel.

Seminole — Unbreakable chisel steel.

Silcrome — Non-corrosive electrical resistant steel.

Delhi Hard — A non-corrosive steel for a thousand uses.

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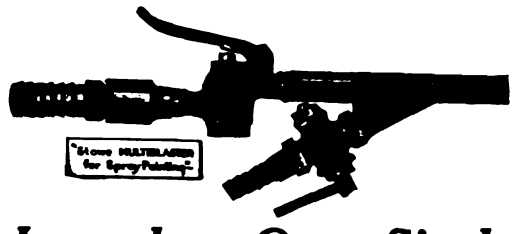
Iroquois Special — The edge holding tool steel.

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Multiblaster for Mechanical Application of Paint

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(Continued from page 71)

week, as well as a rapidly growing shipment through the canal of refined products. Oil in bulk pays the government about 14¢ a barrel in tolls. Nearly half of the present income of $60,000 per day earned by the canal is therefore derived from California oil. It is within the realm of possibility that California oil will make the building of a second Isthmian Canal, or the enlargement of the old one, necessary and profitable.

An inspection of California's oil marketing system reveals the same ingenuity, the same attention to engineering details, and the same determination to cope with the changing demands of the consumer, as are characteristic of other phases of the industry.

From the refineries, oil products are transported by tank car or boat to large industrial users and to hundreds of distributing plants located at strategic positions throughout the Pacific Coast states and the Orient. Each plant consists of storage tanks, warehouse space for drums and package goods, and facilities for loading the trucks and railroad cars by which deliveries are made to local customers.

Four of the large oil corporations and a number of smaller companies now operate their own service stations for the benefit of the motoring public. The first service station on the Pacific Coast was opened in Seattle in 1907. In common with all of the early "filling" stations, it was intended merely to dispense gasoline and had none of the numerous features devised in more recent years for the comfort and convenience of the motorist.

Every town of any size in the State now has several service stations operated by the larger companies. In addition, there are numerous privately owned service stations and hundreds of garages which sell motor lubricants and fuel. Competition is extremely keen, both in giving service and in making the stations as attractive as possible.

All of the leading oil corporations operating in California have paid special attention to their employees. Not only has oil proved one of the State's richest financial resources, but it has given opportunity to thousands for a useful and happy life. The oil fields are everywhere characterized by well-paid, well-housed employees. Through the efforts of the larger companies, and with the coöperation of the State Housing and Immigration Commission, the oil camps can scarcely be surpassed in comfort and sanitation.

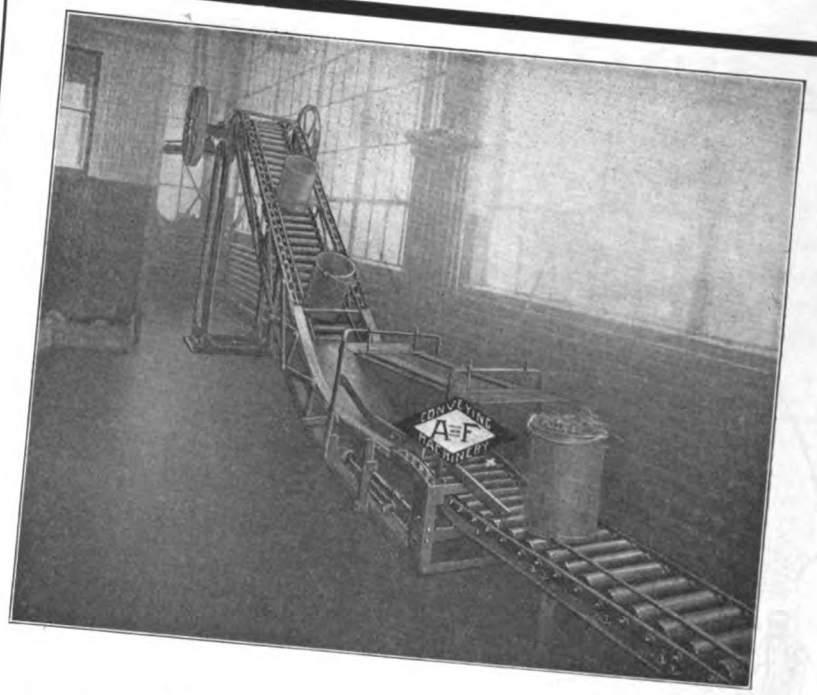
Taft, Coalinga and Bakersfield, in the San Joaquin Valley fields, are classed among the richest high school districts in the United States. The children of oil field employees have opportunities for the best of secondary school training. The influx of numerous young, well-educated men has put upon the industry a demand for further training. Several of the oil companies maintain extensive educational departments, and the high schools located in the producing fields have coöperated with the operators in offering both day and night courses for the training of oil workers. Both the University of California and Stanford maintain departments in chemistry, geology and petroleum engineering, in which excellent courses are offered for the training of young men desiring to play their part in the State's petroleum industry.

Stock selling, bonus plans or profit sharing have been used successfully as financial rewards by several of the corporations, thus furnishing a good basis for interest in work which has a natural appeal because of its place among the basic industries.

Safety work is being well developed everywhere. Six of the leading corporations recently coöperated in producing a four-reel film on this subject, which is now being shown to thousands of employees in California and is being displayed to oil workers and others throughout the United States by the Bureau of Mines.

In view of the startling, almost kaleidoscopic, changes during the past decade, one cannot risk much in the way of prophecy as to the future trends in the California oil world. Certain basic facts must, however, be clearly recognized by both investors and would-be regulators.

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Consequently the Sarco cannot freeze.

Steam trap Sarco keeps the lines drained at all times. There is no big body of water in the trap to cool the steam and reduce it to liquid.

Has only one moving part. No levers, gauges, stuffing box, etc., to corrode or gum up and stick, and cause the trap to stay open and waste steam.

Can be screwed into pipe line at any angle and takes practically no space. No platform, pit or support needed.

Although the Sarco has many exclusive advantages, it costs but one-third the price of most traps.



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Non-shrinking tool steel.

SEMINOLE
Unbreakable chisel steel.

SILCROME
Non-corrosive electrical resistant steel.

DELHI HARD
A non-corrosive steel for a thousand uses.

MOHAWK EXTRA
Unexcelled high speed steel.

PURPLE CUT
A better high carbon steel.

NEVA-STAIN
Special non-corrosive steel.

Iroquois SPECIAL
The edge holding tool steel.

POMPTON
A carbon tool steel.

DELHI TOUGH
Tough a rustless easy cutting alloy.

LUDLUM SPECIAL STEELS — LUDLUM STEEL COMPANY — STEELS SPECIAL PURPOSES — WATERVLIET-N.Y.-U.S.A.

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All of the leading oil cor- orations operating in Cali- rnia have paid special atten- on to their employees. Not nly has oil proved one of the tate's richest financial re- sources, but it has given op- portunity to thousands for a useful and happy life. The oil fields are everywhere charac- terized by well-paid, well- housed employees. Through the efforts of the larger com- panies, and with the coöpera- tion of the State Housing and Immigration Commission, the oil camps can scarcely be sur- passed in comfort and sanita- tion.

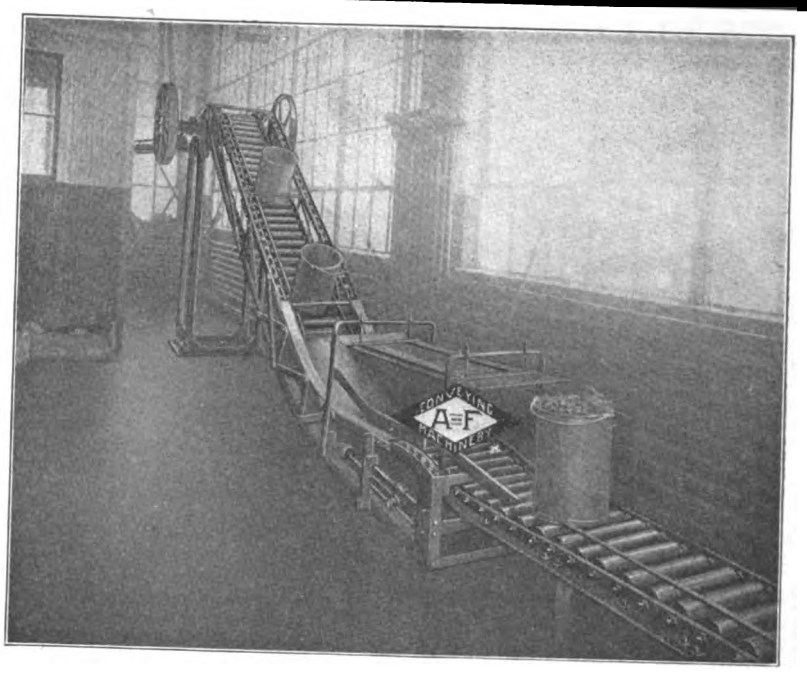
Taft, Coalinga and Bakers- field, in the San Joaquin Val- ley fields, are classed among the richest high school districts in the United States. The children of oil field employees have opportunities for the best of secondary school training. The influx of numerous young, well-educated men has put up- on the industry a demand for further training. Several of the oil companies maintain ex- tensive educational depart- ments, and the high schools located in the producing fields have coöperated with the operators in offering both day and night courses for the train- ing of oil workers. Both the University of California and Stanford maintain depart- ments in chemistry, geology and petroleum engineering, in which excellent courses are of- fered for the training of young men desiring to play their part in the State's petro- leum industry.

Stock selling, bonus plans or profit sharing have been used successfully as financial rewards by several of the cor- porations, thus furnishing a good basis for interest in work which has a natural appeal be- cause of its place among the basic industries.

Safety work is being well developed everywhere. Six of the leading corporations re- cently coöperated in producing a four-reel film on this subject, which is now being shown to thousands of employees in California and is being dis- played to oil workers and others throughout the United States by the Bureau of Mines.

In view of the startling, al- most kaleidoscopic, changes during the past decade, one cannot risk much in the way of prophecy as to the future trends in the California oil world. Certain basic facts must, however, be clearly recognized by both investors and would-be regulators.

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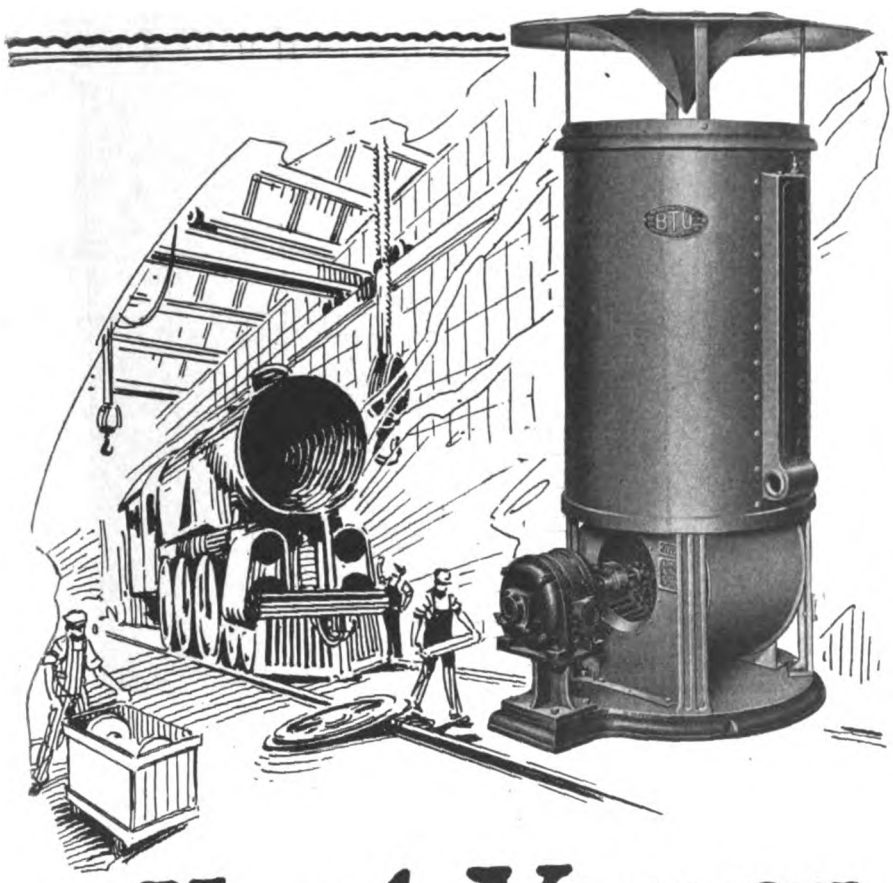
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of the daily production of the State comes from a relatively small percentage of the total number of wells still capable of yielding a fair amount of oil. As the flow from these large producers declines, and as the richest yields are fully drilled, the familiar cycle must be repeated; smaller producers will be pumped again, and the extension of proven territory by drilling will be renewed to keep pace with market demands. The rate of decline of the wells in Southern California is known to be fairly rapid, but just how long the field will continue to occupy its present leading position in production is problematical. Sooner or later, the question of operating a large number of small producers under very economical methods must again come to the fore and all the attendant problems of engineering and maintenance will crowd for attention.

Not all of the money lost in oil has been spent on wildcat drilling. The erection of refineries has been overdone in Texas and the sad experience of that state bids fair to be repeated in California. New concerns are entering the field who do not appreciate that additions to refinery capacity made by the older corporations are merely part of a development program outlined months ago, a program not based on flush production from new fields, but upon the gradual growth of their own business and their faith in the future conservative output of carefully managed properties.

From the point of view of the small conservative investor, the stock of companies owning and operating pipe lines in good territory is likely to continue to offer an unusually attractive, but generally neglected, opportunity. This means of transportation is essential to the industry and will be expanded in California as in other parts of the United States.

Expansion of marketing organizations and of service and transportation facilities for sales departments will unquestionably occupy a foremost place in future activities. Means for increasing efficiency and encouraging economy in marketing must be found. As in other industries, present distribution costs are too large, partly because of the demands made by customers for service, and in part because the problems involved are too new to have demanded effective solutions.

The trench hat, the "old tin hat" that served in some measure to turn shrapnel hail on the war-swept fields of France, is coming into quite extensive use as a means of head protection against falls of rock and ore in the mines of California, West Virginia, Oklahoma and many other states, according to R. V. Ageton, metal-mining engineer of the Bureau of Mines, Department of the Interior. "The hats are being used in shaft sinking and in raising operations and around and in hoisting shafts," states Mr. Ageton. The "trench shoe" and similar heavy shoes are also being utilized by miners as a medium of foot protection.

Stiff protective hats are still widely used in some mining districts, but in general the custom of wearing stiff hats is not nearly so common in mines of this country as it should be, probably because a large proportion of the foreign-born miners, as well as many American-born miners, now come to the mines from other occupations, without previous knowledge of mining, and do not appreciate the importance of protecting the head and foot from minor accidents. In recent years, however, the Bureau of Mines has noted a gratifying increase in the use of protective devices for the head by the miners of this country. Many of the soldiers had been miners, and came back with a wholesome respect for the trench helmet and the trench shoe. After being discharged, numbers returned to the mines, and brought with them the trench hat and the thick trench shoes. As one miner in an Oklahoma zinc mine expressed it, "If 'the old tin hat' would stop shrapnel, I reckon it'll stop these small pieces of 'jack.'"

Both miners and operators have been quick to recognize the advantages of these wartime devices for mining use, and at least one mining company was so impressed that it bought a large quantity of trench hats and distributed them to its employees.

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The Aristocracy of Education

BY JOHN FLODIN

RECENTLY the expressions "Aristocracy of Education" and "Aristocracy of Brains" have been given considerable newspaper prominence and have caused much unfavorable comment. This last was to be expected. It is but natural that people who cherish the doctrine of equality would decry anything that threatens its sacredness, and all the more so if at the same time some real or imagined privilege of theirs was placed in jeopardy. But it is rather surprising to learn that so prominent an educator as Dr. Augustus O. Thomas, state superintendent of schools for Maine, should plead absolute equality. According to press reports, Dr. Thomas, in addressing the New England Association of Colleges and Secondary Schools, warned against "any propaganda which will tend to set up in this country, among our children, common and preferred classes." Dr. Thomas continued: "The tendency to select the 5 per cent. of superior mentality as college entrance is a false theory and a backwash of the caste system. We do not want even an educated few to be known as an educated aristocracy of America.—Education is not nectar to be drunk only by the gods It is *aqua pura*, the drink of the masses of mankind. Education is for every one who may desire it.—"

These sentiments are idealistic and perhaps they can be defended on the basis of some pedagogical theory. But from a practical, workaday point of view, would such wide, inclusive education, granting for the moment its possibility, be an unmitigated good?

Presumably Dr. Thomas does not wish to be taken literally. He, as a teacher, knows full well that every year there is a goodly number of children sent from grade and high schools to reform schools because of some mental twist that from the beginning of their careers separates them from their fellows. He undoubtedly knows that the educational institutions established for the feeble minded and mentally deficient are taxed to capacity practically throughout the country, and that many a subnormal child is kept in school—and this is true in most parts of New England—because there is no room or adequate provision for him in the reform or special schools.

Nature, then, is forcing on us a division into castes because of mental differences —differences that may perhaps

(Continued on page 77)

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The grocery business and the steel business—so unlike in externals—are precisely similar in their fundamentals. The man who knows these fundamentals—sales, accounting, factory and office management, costs, advertising, corporation finance—is the man who is sought for executive responsibility.

With such an equipment you become immediately a more important factor in your present business; for you have something to contribute to the plans for every department. And if your present business offers limited opportunities, you can step into another and find yourself equally at home.

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Presidents and Business Heads	27,198
Vice-Presidents	8,294
Treasurers	7,358
Secretaries	9,951
Controllers	1,496
Sales Managers	6,879
General Managers	6,225
Managers & Dept. Heads	37,187
Auditors	4,779
Salesmen	8,453
Superintendents	7,882
Advertising Managers	4,911
Accountants	7,690
Traffic Managers	2,675
Credit Managers	2,983
Bank Cashiers	3,142
Chief Engineers, Chief Draftsmen, Chief Chemists, Chief Metallurgists	2,513
Engineers, Chemists, Metallurgists	18,119
Draftsmen, Office Managers	12,529
Chief Clerks	2,969
Purchasing Agents	9,093
Professional Men	8,741
Miscellaneous	201,067
Total	

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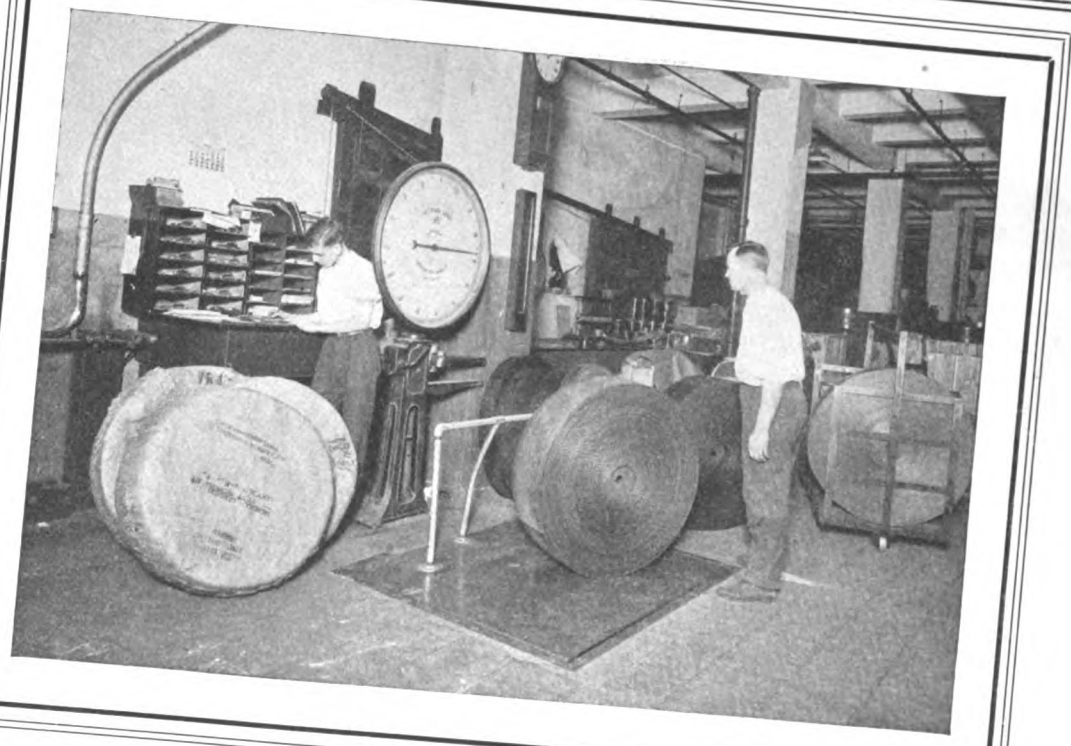
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(Continued from page 75)

be overcome when science learns to master mental defects and weaknesses. But that is Utopian; that is a thing to dream about, not to use as a basis for conduct or for serious discussion.

It may seem reasonable to leave the mentally deficient out of consideration, but where is the line to be drawn? Most of us know men who are college graduates and who yet seem to fall far below the level of an educated person, and perhaps even below the average intellect of people with much less school education. This may be partly due to faulty educational methods or to a faulty system, but it is at least in large measure due to over-education of persons who are not innately equipped to profit by the education offered and received. For even if we leave out of consideration all those who manifestly are unfit for serious study, we are still facing the problem of all those who perhaps could satisfactorily carry on the work and pass the examinations in high school and college, but to whom the learning imparted would be of no value. There are many who cannot apply what they have learned. There are many who can memorize and who can, in a manner, understand what they memorize, but who cannot truly assimilate their learning. The effect of higher education on them is often only to heighten their demands on life. They expect to be recognized and employed as men of ability, with all the privileges and the compensation due for ability, because they do not see the distinction between superficial learning and the ability that results when thorough education is built and superior innate qualities. And when they fail to make the expected progress they often become embittered and, what perhaps is worse, they become an example for hesitating, questioning, intelligent youths of the futility of higher education. Yet it is often people of just this type who clamor most loudly for equal opportunities in education. In many instances they could be far happier and far more useful to society if a greater part of their training had been of the practical kind we usually term experience. Unfortunately we are not yet ready to attempt to prescribe in detail just what kind of education or training every individual should have, nor how far that education should be carried, but in very many cases we can say with considerable amount of assurance whether further schooling will result advantageously for the individual and for society.

The nation can scarcely afford to educate men whose value does not increase commensurably with the education received. The cost of education is even now enormous, and it is growing at a rapid rate. The value of the time lost is incalculable. On the other hand, the state cannot afford to fail to educate men whose value may be immeasurably enhanced by proper education. This means that an aristocracy of education must be based on the natural aristocracy of intellect, and that it is the business of every educational system to establish as its ideal the training of all people in accordance with their intellect, ruthlessly discarding the fal-



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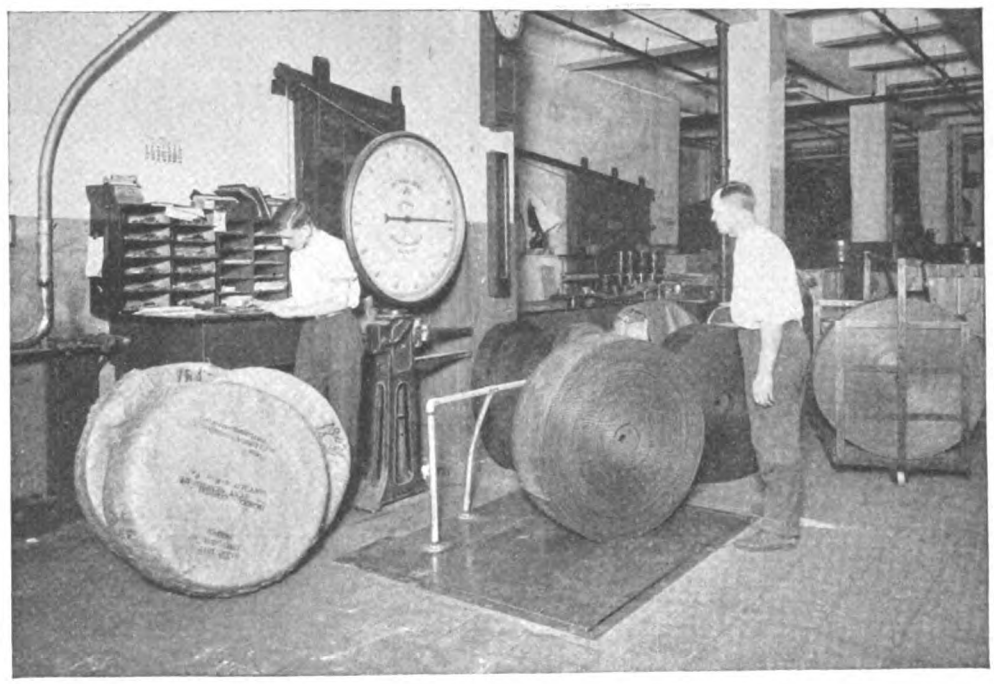
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lacious doctrine of equality.

Perhaps an illustration will make this point clearer. Three years ago, while visiting Finland, I met two men, both of whom had been subjected to the regulations of the educational system of that country. One of them—he was about forty years old—was the son of a man of considerable wealth and influence as well as of high cultural attainment. The son, however, did not measure up to the requirements. He flunked out of college, nor could all the influence of the father win him admittance to any other educational institution of higher rank than trade school. The boy finally became a machinist, and when I met him he was in charge of a large machine shop, evidently satisfied that he had found his proper sphere in life, and evidently giving very satisfactory service. The other man was 45 years old, the son of a farmhand. From the first year of his school life the boy was without money, without friends, without influence, but possessed of a high order of intellect which was duly recognized. From the country grammar school he was sent, at state expense, to the high school in a near-by town, later to the university at Helsingfors, and finally abroad for several years of further study. The state, through its educational system, had recognized his superior qualities, and had seen to it that his aristocratic birth-right was not denied him. This man is today considered a high authority on bacteriology, and the increase in his value to the country has undoubtedly been well worth the expense and the forethought expended not only on him but also on others who may not have so fully justified the expectations of those in charge.

This, it should be remembered, was in a country where the feudal inheritance of aristocracy still was an established and cherished institution when these two men were young. Yet no tradition of aristocratic birth, nor any notion of the power of wealth, was allowed to interfere with the ideal of an aristocracy of intellect. To what extent this ideal may be recognized in other countries I do not know, but it is well to remember that all, or nearly all, European countries have systems for granting state stipends for study at home or abroad. Even Japan is spending large sums for the purpose of having the most promising members of the rising generation as highly educated as possible, while we in the United States, who are wont to regard our civilization as of a higher order, leave the matter of stipends to philanthropy.

It should not, however, be our ambition to copy what may have found popular favor, elsewhere, nor yet to continue along a path into which we may have drifted for no better reason than that staying on that path means pleasing a majority of which the aristocracy of intellect is not a part.

It is a well-known fact that the students set the standard of proficiency in American colleges, and that that standard in most instances is lower than the standards in European schools of equal rank. I do not mean to say that the value of the education offered in this

(Continued on page 81)



If You Had to Wear Your Overcoat in Your Office

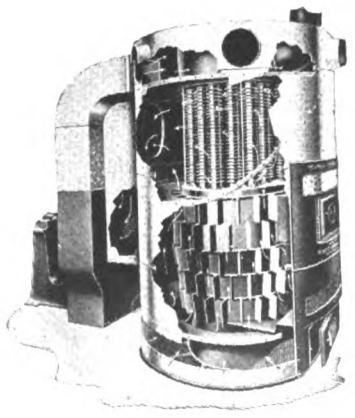
—you would be more interested in keeping warm than in working.

If your employees are forced to work in a cold, drafty shop, they can't deliver all the work of which they're capable. Like you, they pay more attention to personal comfort than to production working—it's only human nature.

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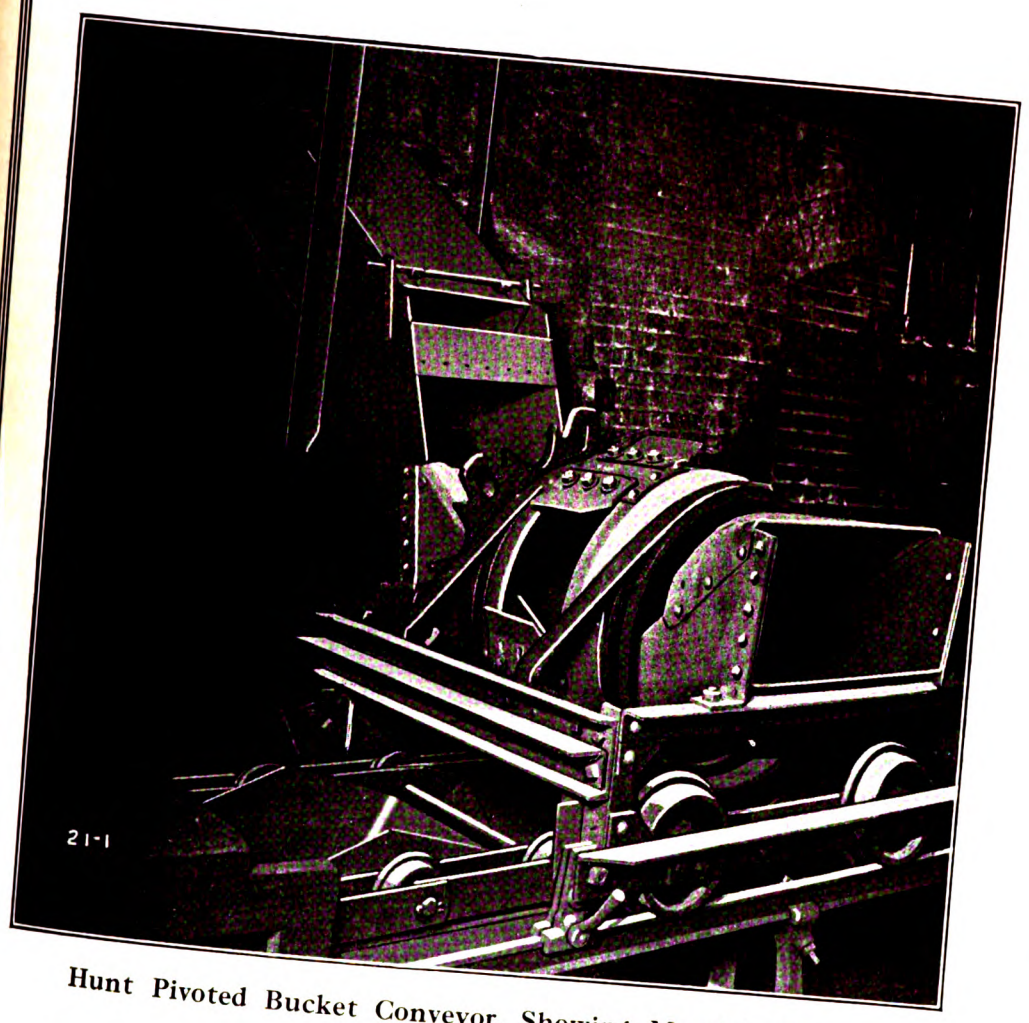
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When Coal Was a Nuisance

"In the year 1306, coal was so generally used in London that a petition was sent to Parliament to have the use of it suppressed on the ground that it was a NUISANCE."

From an Article by Elisha Gray in "Modern Achievement"



Hunt Pivoted Bucket Conveyor, Showing Movable Filler

The buckets are loaded by a filler of the revolving drum type, which is driven from the conveyor chain, through a wheel designed to properly engage in the links of the chain. The filler moves in perfect synchronism with the conveyor and gives an equal charge to each bucket, filling each bucket to capacity without spilling the material over the edges or between the buckets. It furthermore prevents dust and grit from getting into the working parts of the conveyor.

The filler is provided with a chute which can be adjusted to handle any size of coal without flooding or spilling. The filler can be set up at any point of the run where it is desired to fill the buckets; can be moved from place to place as necessary.

CAN any reader of these lines imagine that this commodity, absolutely vital to the industrial life of today, could be held in such little esteem by the Londoners of the twelfth century as to "have its use suppressed" by act of Parliament? It is inconceivable!

Today the exact reverse is true when the entire National, State and local Governments, are importuned to pass drastic laws to compel a sufficient supply of what was once termed "a nuisance."

That the meagre stock now available and the coal that will eventually reach the consumer, on the termination of the coal strike, will demand exorbitant prices is quite understood; then why make the handling and rehandling of what is received, more costly by the use of obsolete or inadequate methods or apparatus?

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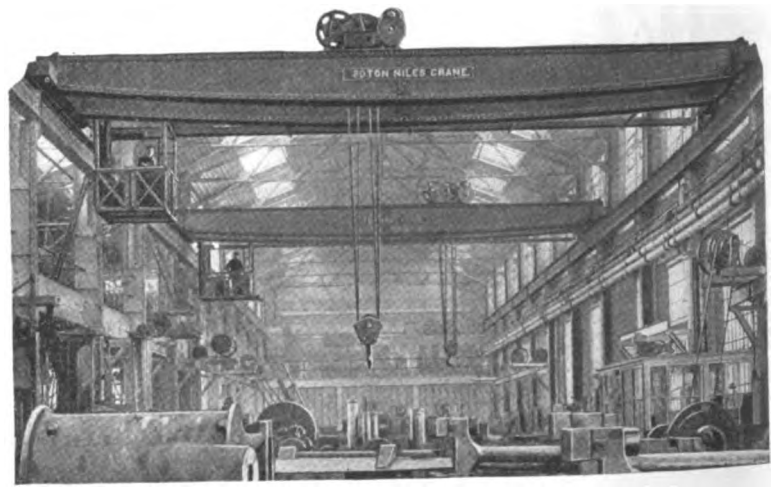
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(Continued from page 78)

country has been seriously impaired by this state of things, but I am firmly convinced that the more we adhere to the doctrine of equality the more difficult it will be to maintain reasonably high standards. This is a more serious matter than it may seem, for the more the standard of intellect and of scholastic attainment is lowered, the more will those be held back who are made of a finer clay.

The squelching of the eagerness of the brighter youths may not be entirely avoidable, but surely it should be recognized as an evil that should at least be held in check as far as possible. Yet there are many instances where the equality doctrine is applied so indiscriminately as to all but defeat the purpose of the education offered. This happened, for example, recently in an evening class given in Boston under the auspices of the University Extension of the Commonwealth of Masachusetts. The work of the students who wanted to take the course to satisfy a real need, and who were mentally qualified to profit by the instruction they reasonably could expect to receive, was so hampered because of the low standard of the class that many of them dropped out, some of them registering for a similar course given in a suburban town where the other students happened to be on a higher intellectual level. Naturally, the instruction given in the Boston course had to be modified to suit the majority in the class, for to raise that majority to a standard established beforehand was manifestly impossible. No doubt the class profited to some extent by that course, but the gain, from the larger, social point of view, can have been but slight as compared to the loss sustained by those others who might have profited immeasurably if the standards of the instruction had been high enough and rigid enough. There is a real danger in this. It is robbing Peter to pay Paul, but giving Paul only a fraction of what Peter had to sacrifice. And Peter's loss is the Nation's loss—the loss of an aristocracy of educated intellect.

THE recent drastic reductions in the prices of gasoline are the natural consequence and expression of a situation which has been in process of development for at least two years. Over-production of oil during this period, and the resulting accumulation of stocks of crude petroleum and its products, have been regarded with growing concern.

Clearly, relief must be sought either in reduced production of crude oil or in increased consumption of oil products.

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(The Guaranty Survey)

Speaking of elevating trucks—

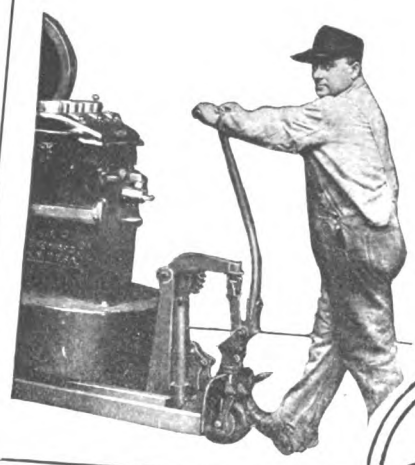
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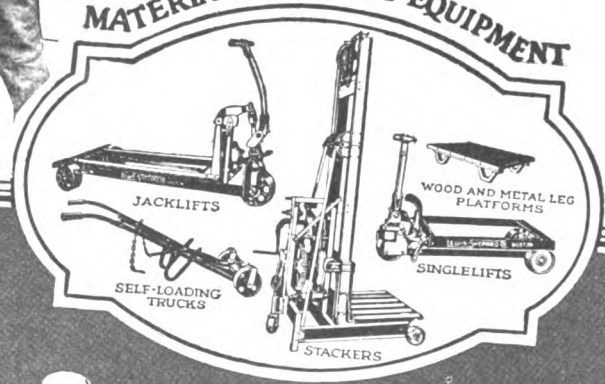
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The *R-W 925 Trolley* is made in seven capacities, ranging from ¼-ton to 4-tons. All are described in Catalog DD-23, a copy of which will be sent to any manufacturer on request.

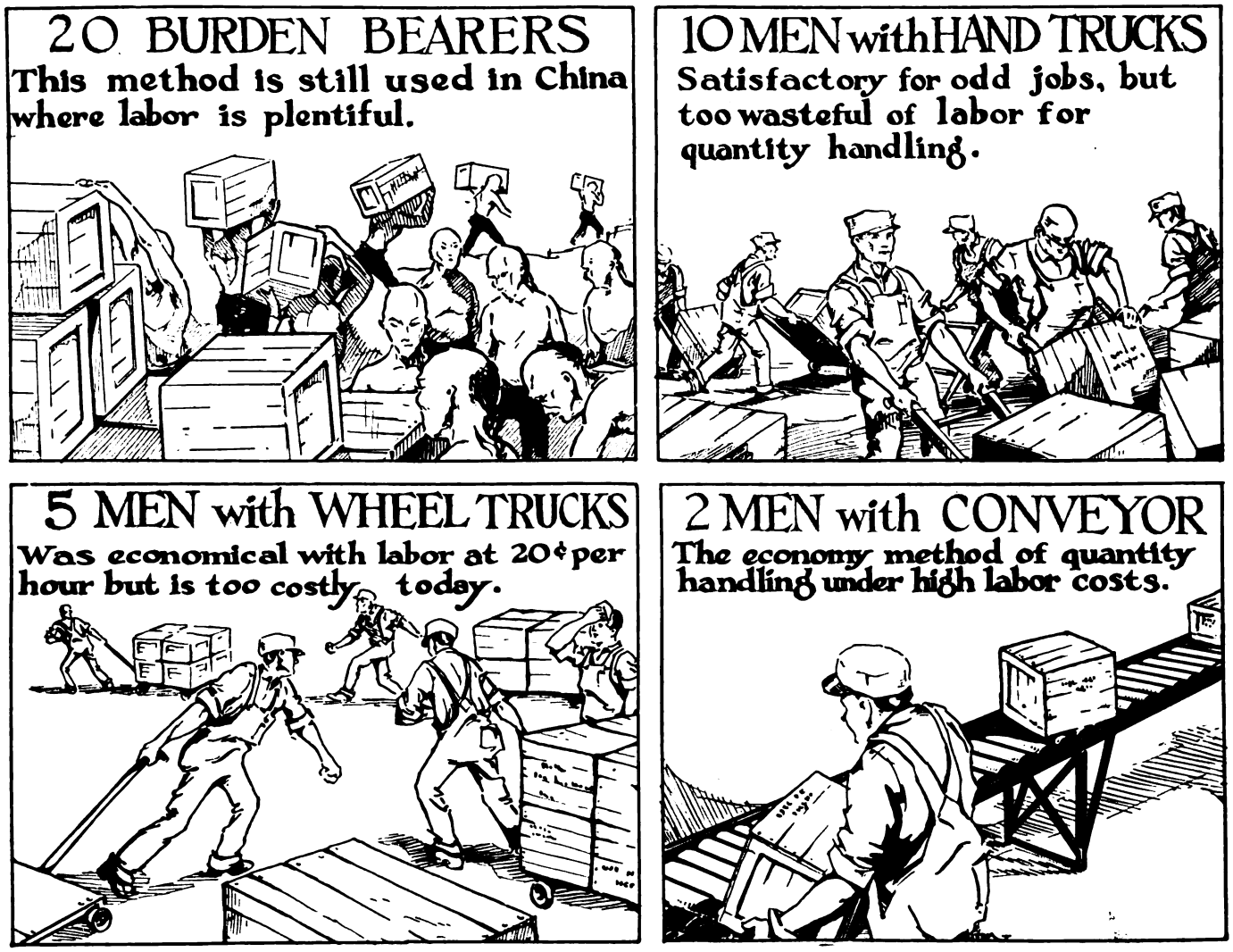
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ONE secret of industrial economy is to balance labor-cost against machinery-overhead; and to adopt the cheapest method.

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The pictures on this page show how rising wage scales are offset by the use of more economical material handling equipment.

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But with move-men receiving 40, 50, and even 60 cents an hour, hand methods are too wasteful of labor where goods are moved in quantity. More economical equipment ***must*** be used. Conveyors save so much in labor cost, that their economies far more than offset the moderate machinery-overhead that they add.

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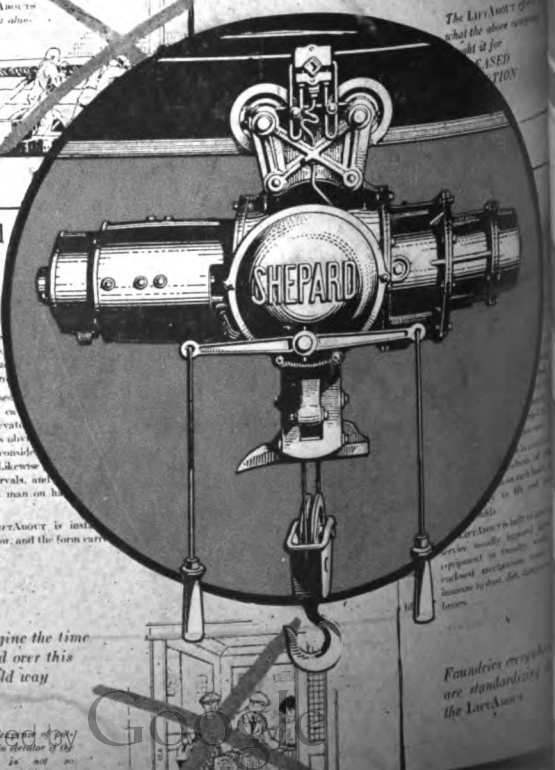
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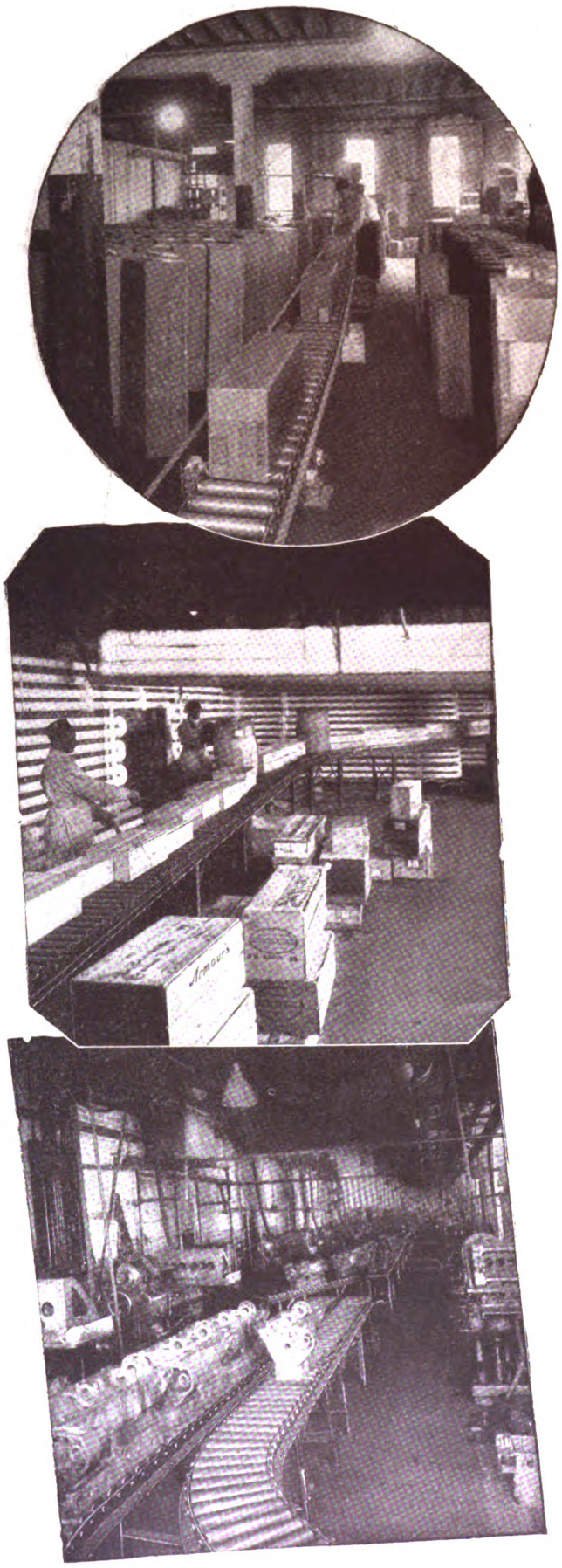
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Glance at the pictures on this page and you will confirm the truth of the statement that there is a Standard Gravity Roller Conveyor for every load.

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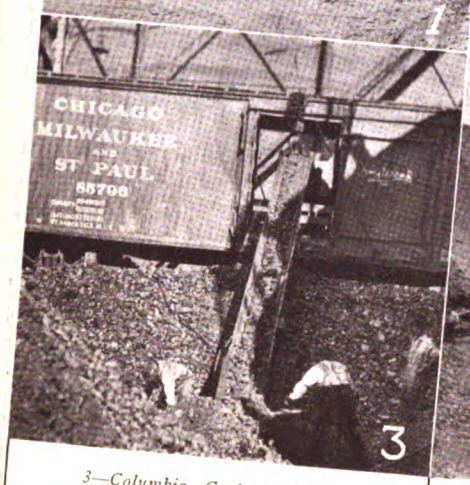
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1—U-Type Barber-Greene reclaiming coal from storage into wagons.



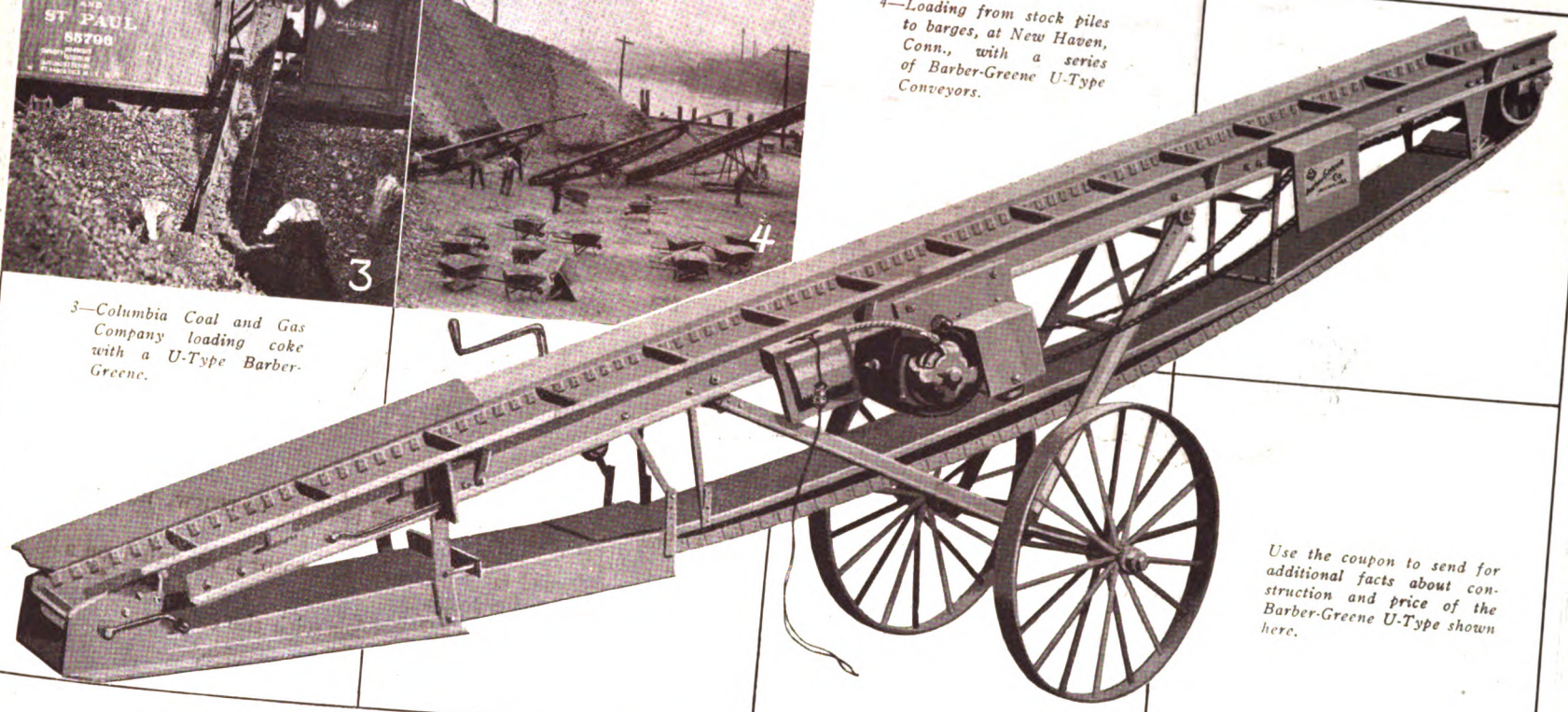
2—Peter De Lass and Sons unloading 100 tons of coal in one day direct from car to truck with two men.



3—Columbia Coal and Gas Company loading coke with a U-Type Barber-Greene.



4—Loading from stock piles to barges, at New Haven, Conn., with a series of Barber-Greene U-Type Conveyors.



Use the coupon to send for additional facts about construction and price of the Barber-Greene U-Type shown here.

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Because the price of the U-Type Barber-Greene Conveyor has been reduced to $350 you can now avail yourself of many Barber-Greene advantages at a very small investment.

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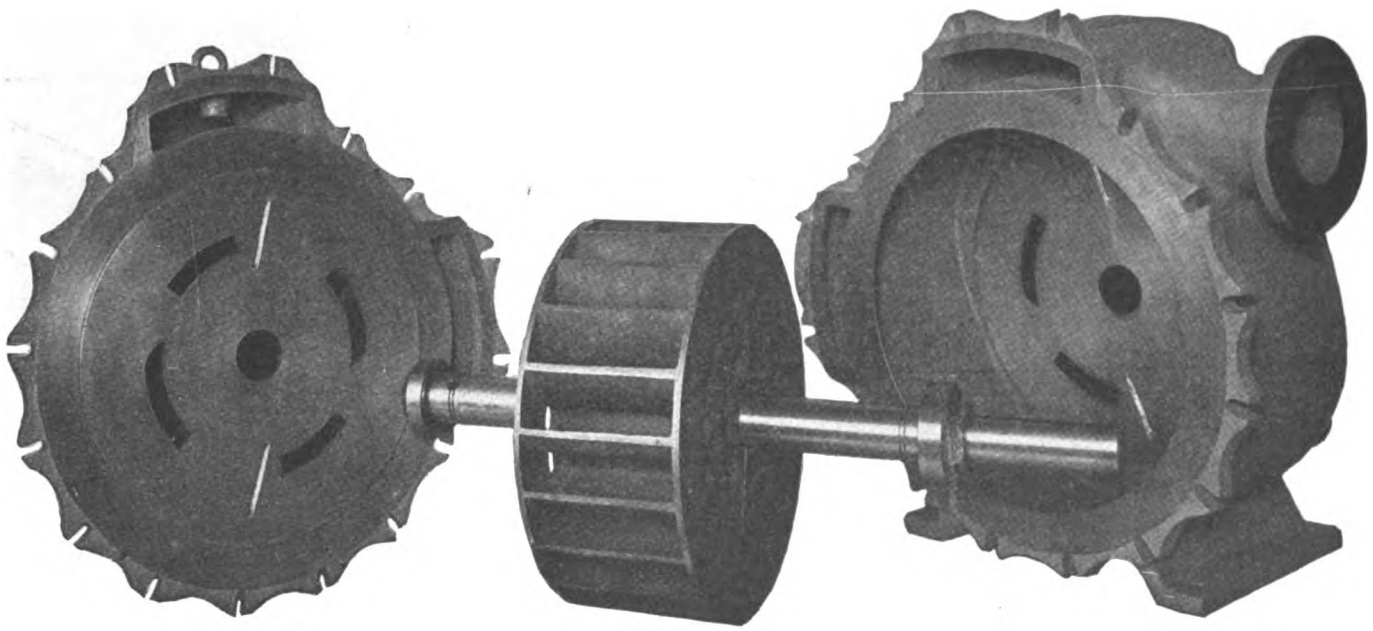
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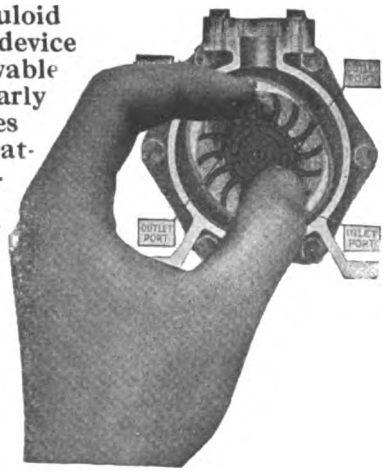
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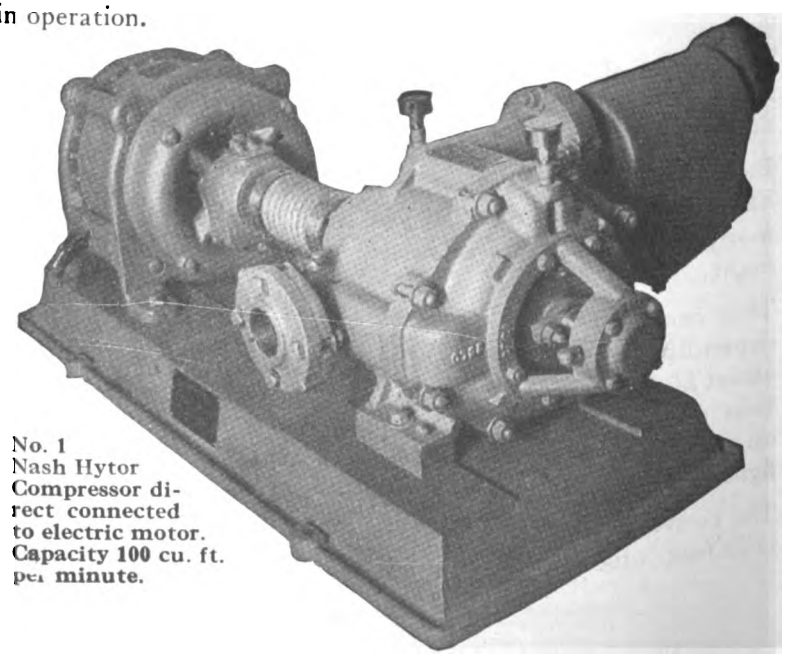


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EDITORIAL

What About Maintenance?

THERE is a story about a certain newly elected railroad president, who, wanting to stimulate loyalty among the rank and file, decided to reward those employees who had seen the longest service with the road. The records disclosed that an individual, whom we may call John, had been with the company for some forty years. He was sent for, and after congratulations, the new chief asked him what his duties were. "John" explained that he was one of the men who, when a train pulled in, tapped the axles and wheel flanges with his little hammer.

"Well, John," said the other, "I'm more familiar with the financial side of railroading; and, just between you and me, I've always wondered what you fellows do that for, but was ashamed to ask. Why *do* you tap 'em that way?"

"Gosh," said John, "I dunno what for; all I know is, that's me job."

Now that is supposed to have happened quite a few years ago—and it is only fair to assume that today, none of us is quite so abysmally ignorant with regard to maintenance. Nevertheless, it is safe to say that at least three-fifths of our industrial plants are suffering heavy financial losses resulting from *neglect* of maintenance.

We know that wood is subject to decay; and proper painting safeguards it. We know that iron and steel are subject to rust; and paint or oil, or a coating of some impervious metal protects it from rust. We know that windows become dirty and thus cut down the natural light, affecting production and increasing the cost for artificial light. We know that a leaky valve or joint in steam or air lines is a steady, continuous drain in actual dollars and cents. We know that it costs less to inspect and repair a roof today, than to let it reach a point requiring entire replacement next year. We know that a belt which is allowed to run without inspection and periodic repair, is very likely to cause damage, as well as a shutdown of production, when it does let go. We know that neglect of oiling, in the long run, is a hundred-fold more costly than the most expensive lubricating system.

All these things—and many more—we know. But, either through a sense of false economy, or through mere procrastination, two-thirds of the industrial plants of the country have so far failed to put that knowledge into practice; and, in these plants, more than one-half the potential profit is thereby going to waste.

It is one thing to describe a condition, and quite another to set about remedying that condition. With that in mind, we have arranged for a series of articles—the first of which begins on page 8 of this issue—designed not merely to tell of the various important factors of maintenance, but to show how they should be handled.

In this, and succeeding issues of INDUSTRY ILLUSTRATED, we plan to show the executive, the maintenance man, the engineer, and the man on the job, how to get the utmost in service from his plant and equipment, how to hold down depreciation and minimize breakdowns—in short, how to recover that half of the realizable profits that is now being lost.

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The Industrial

What Maintenance Means to Pro

BY WILLIAM

THE subject of plant maintenance has not received the attention it should have received in the past, due to the fact that the average manufacturing executive has not linked up maintenance with production. However, they are inseparable and the keen executive who is looking forward to lowering costs as a prerequisite to increased sales will do well to give the problem of maintenance its due share of attention. We all know that we cannot get the orders out on time if we have breakdowns in important units just when we need them most. However, a great many of us take these breakdowns as a necessary part of the production game and don't really make a serious effort to overcome them. If the product is to flow out of the shipping room door day after day without interruption, a well planned maintenance department is as necessary as a well planned production department. How much better it is to pay each week a certain amount to a maintenance crew to take care of small repairs as they are needed than to pay out large



Fig. 1. When this parapet wall was blown over during a wind storm, it broke the joists and roof boards, but the roofing made up of many layers of roll roofing, firmly cemented together, held together and protected the storage room beneath.

Fig. 2. A prepared asphalt roof on one of the buildings of a large tractor plant.

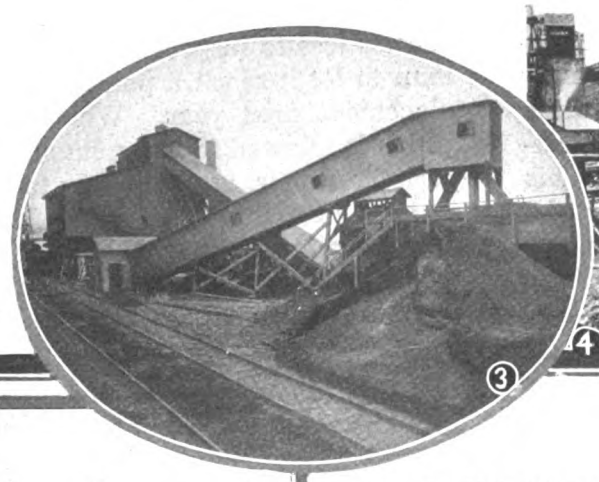


Fig. 3. Moisture and acid fumes at the above plant dictated a choice of asbestos-protected metal roofing.

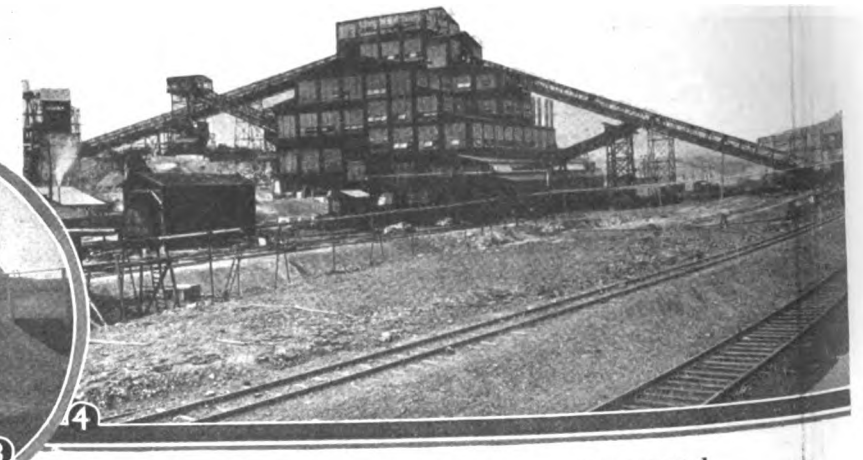


Fig. 4. Here is another case where metal, protected with asbestos, protects the roof of one of the largest coal breakers from sulphurous acid fumes.



Fig. 5. Applying tar and gravel over roofing paper on a flat roof area.



Fig. 6. The finished tar and gravel roof, construction of which is shown in Fig. 5.



Fig. 7. In the tropics, the heat-resisting properties of asbestos, and its immunity to insects and to the ravages of a tropical climate make this type of roof particularly applicable; though its use is by no means confined to the tropics.

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"Daily Dozen"

duction and to the Balance Sheet

By G. Ziegler

amounts every once in a while for night and Sunday work on big repair jobs. It's the old story of "A stitch in time saves nine" in maintenance work. Get on the safe side and get breakdown insurance protection with a well organized maintenance department. Naturally, the method of handling this work varies with the size of the plant. The small plant can get along with a Master Mechanic or jack-of-all-trades who can repair anything from a belt to a building, while in the largest plants the number of men in the maintenance crews runs into the thousands. However, if the efforts of these men are well directed, the expense will pay dividends in increased and bettered production and in conservation of assets in the shape of buildings and equipment.

The primary object of maintenance work is to prevent trouble by making repairs before a break actually occurs.

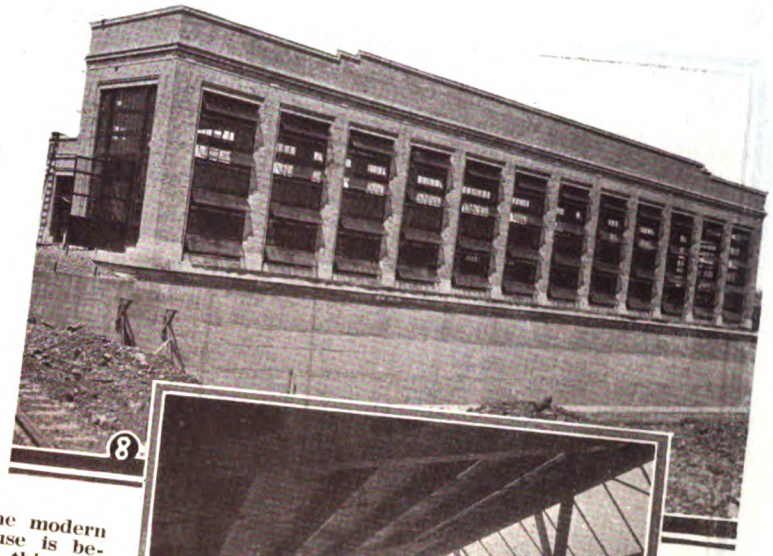


Fig. 8. The modern power house is becoming a thing of beauty as well as of utility, with maximum daylight and ventilation.



Fig. 9. Natural illumination and ventilation through the use of modern steel sash at the Ford Motor Company plant in Canada.



Fig. 11. This shoe factory makes use of daylight by means of modern steel sash and light-reflecting paint, at the same time admitting plenty of fresh air from outside. Note also the ventilating ducts on the ceiling.

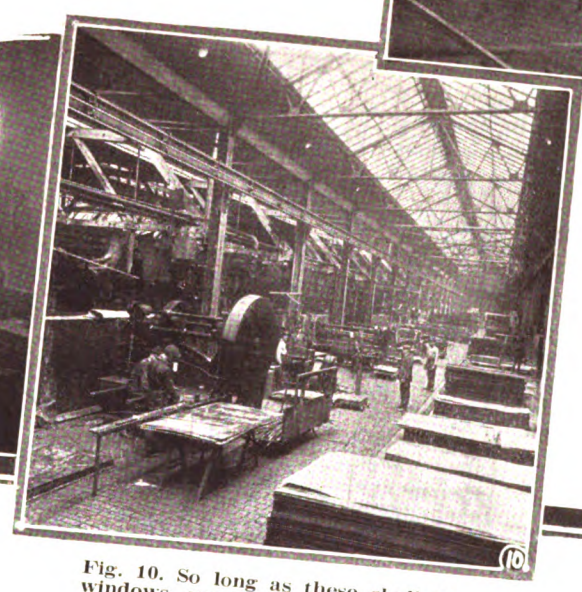


Fig. 10. So long as these skylight windows are kept clean, lighting bills are minimized and production keeps up to schedule.



Fig. 14. At the extreme left is an exhaust fan which connects with the large pipe running along the wall to the exhaust hoods over the buffing wheels. Constant inspection of such a system pays, both in avoiding shutdowns and in lower power bills. White paint on the wall would materially help the lighting.

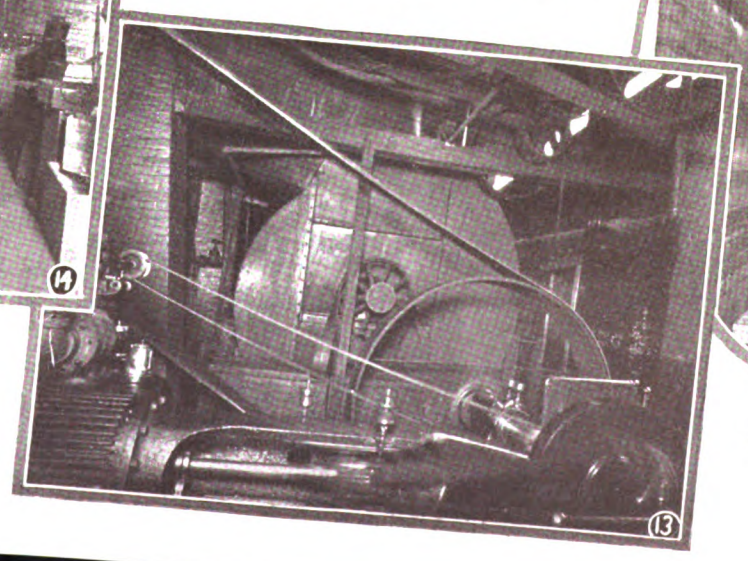


Fig. 13. The large fan in the background below is used for heating the paper room of a large paper mill.

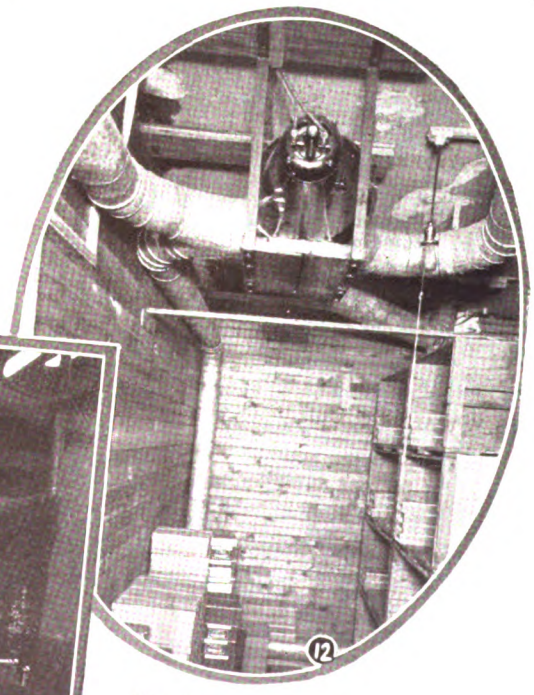
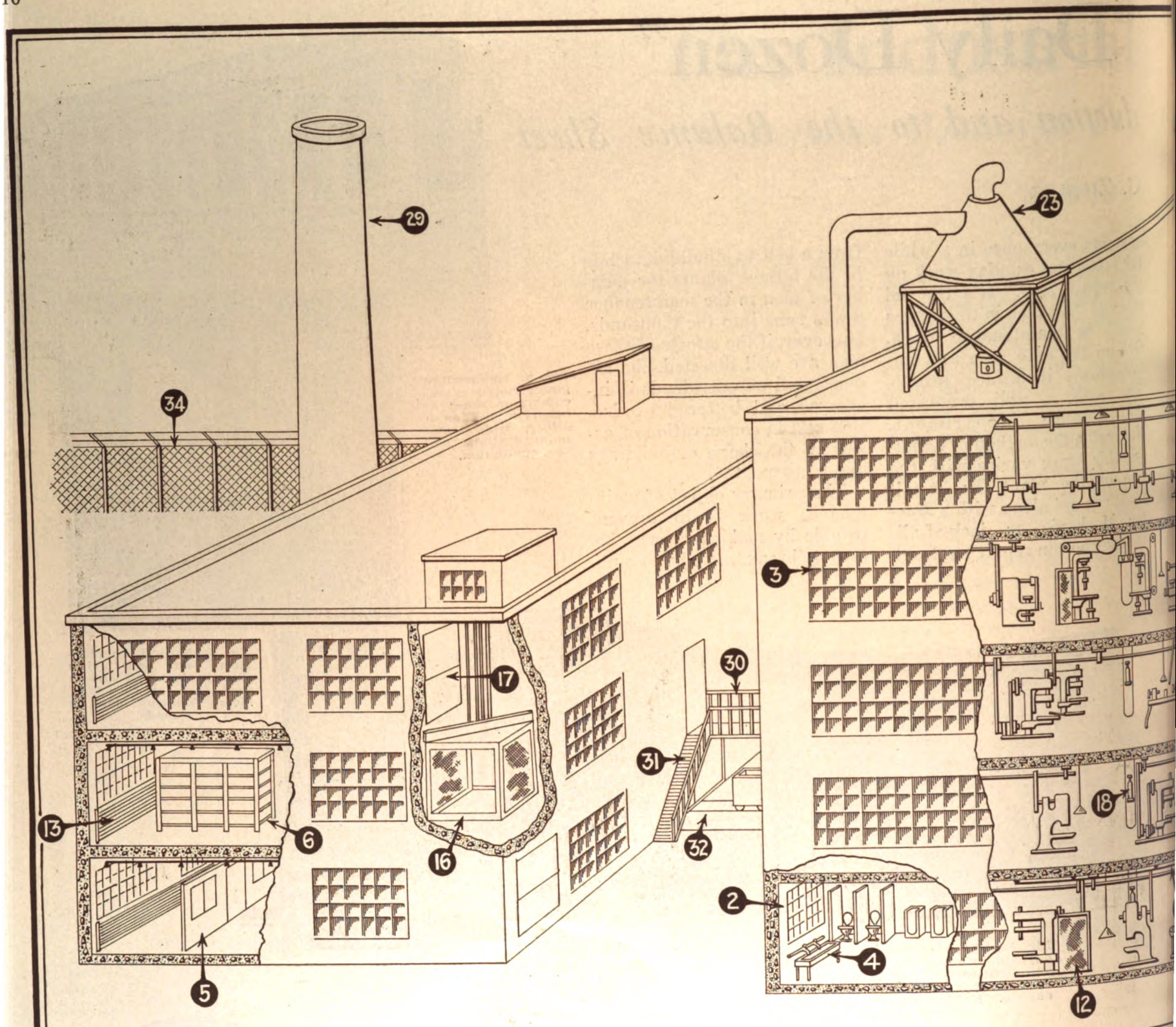


Fig. 12. This ventilating set supplies cold air to a storeroom for boxed candies.

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1 FLOORS.
- Concrete
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  - Paints
- Wood block
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- Cleaning materials
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- Sanding machines
- Vacuum cleaners

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- Sprinkler
  - Pipe, cast iron, underground
  - steel or wrought iron
  - Fittings
  - Valves

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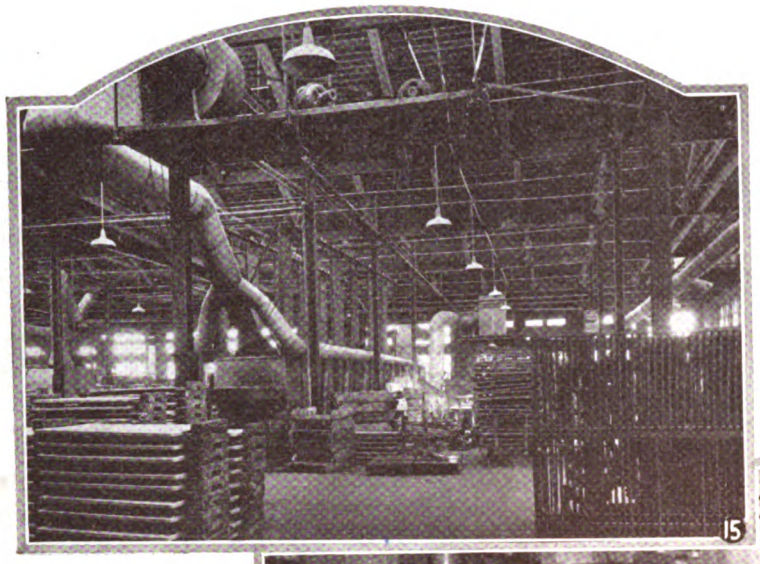


Fig. 15. The fan at the upper left of this picture takes warm air from the furnace to the dryer, while the fan in the background exhausts from the dryer to the outside air. The artificial illumination is by means of large lamps set in white enamelled reflectors easy to keep clean.



Fig. 16. There is no such thing as permanency. This is what happened when a slight defect in a concrete floor was neglected, instead of being properly repaired on its first detection.

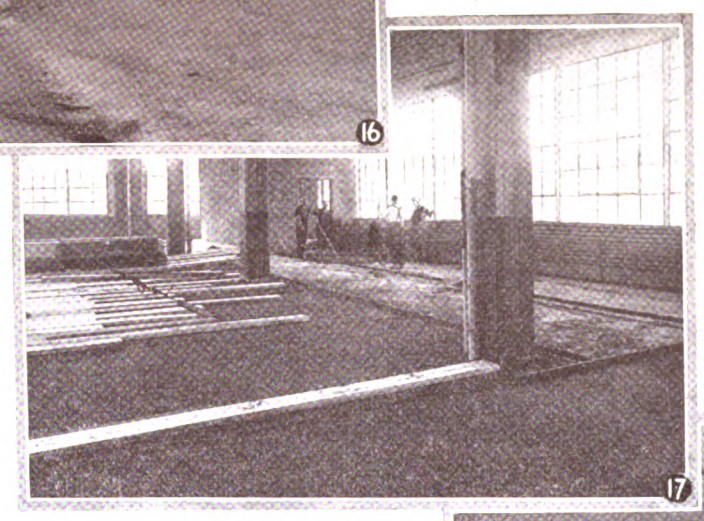


Fig. 17. At the right is an illustration showing the installation of a subfloor over which is laid a wooden floor—making a surface which is resilient, but capable of supporting very heavy loads.

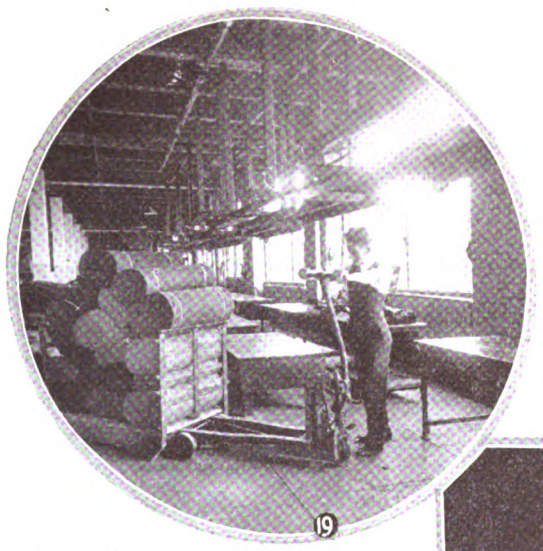


Fig. 19. Sometimes where a satisfactory floor is already installed, it pays to use truck wheels equipped with a non-metallic tread — minimizing noise, and at the same time saving the floor.



Fig. 18. Here is a special composition floor, "smooth as a ballroom," yet fitted to withstand the wear of constant heavy trucking on steel wheels. Notice the absence of beams on the flat concrete ceiling, which, painted white, reflects all the light downward.

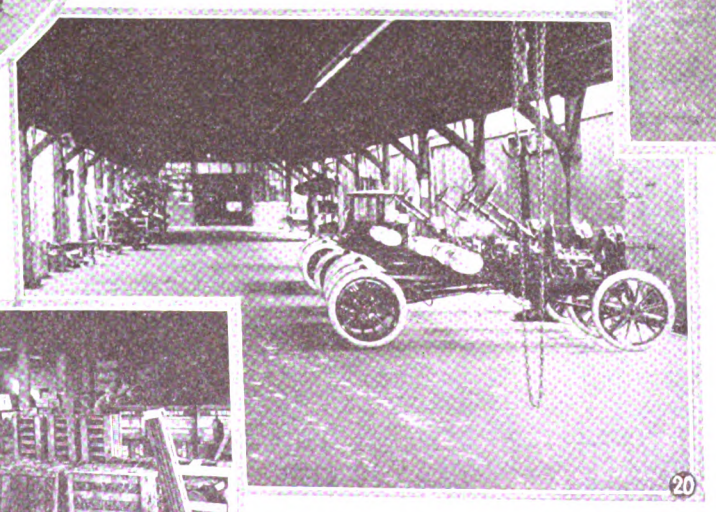


Fig. 20. An automobile assembly plant loading platform, where a wood block floor is giving excellent service.



Fig. 21. Here, again, a wood block floor withstands the ravages of the constant moving of heavy packages.

In large plants, it is usual to have a Plant Engineer in charge of all maintenance work. He has the same rating as the other managing executives and is directly responsible to the Works Manager. Usually there are separate departments with foremen in charge of each, such as: Millwright, Electrician, Pipe Fitter and Plumber, Tinsmith, Machine Repairs, Carpenter and Mason, Painter and Sanitation Departments. It is desirable and necessary that the Plant Engineer should work in close coöperation with the Production Department so that necessary repairs will not interfere with production any more than absolutely necessary.

This series of articles is planned to give to the executives of average size plants an outline of the methods of handling plant maintenance. It is hoped also that the executive of even the smallest plant will be able to gather some helpful hints. The present article deals with the maintenance of structures; in other words, buildings and all their permanent equipment. A great deal of maintenance on buildings could be avoided by specifying first grade materials and workmanship before the building is started, and by having capable inspectors during the construction of the building. Much could be written on this subject but the scope of the present series will not permit more than the mention of this co-relation of maintenance with the quality of original construction. The second article will take up the work of the millwright. Following these there will be a series of articles dealing with the work of the various maintenance departments, such as: Electri-

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cian, Pipefitter and Plumber, Tinsmith, Machine Repair, Carpenter and Mason, Painter, and Sanitation Departments.

The maintenance of the plant itself is practically the same as housekeeping. Floors are to be vacuum cleaned or swept and scrubbed, windows are to be washed, washrooms and toilet rooms must be cleaned and kept supplied with soap, etc. This is a housekeeping job, no more, no less, but in a big plant it's a man sized job to do it well. And cleanliness pays too. There is no question that a man can do more work and better work in a clean, well lighted and well ventilated plant than he can in a dirty, dark and stuffy plant. And as every square foot of floor space costs money it is good business to get as much production as is possible out of every man.

All kinds of flooring will wear out in time, but when repairs are necessary, it is well to study conditions so as to put in the floor best suited to the particular service. There is no one best kind of floor, each has its merits. A floor designed for heavy trucking is not necessary in a light assembling room and vice versa, a floor suitable for light assembling may not be good where heavy trucking is done. Some men who stand on their feet at a machine all day long complain about a concrete floor, especially if it is laid directly on the ground. The writer has overcome this in some cases by making gratings about two feet by four feet at machine for the men to stand on. These can be easily moved when cleaning the floor. As fireproof concrete buildings are coming more and more into use, the men are getting accustomed to concrete floors and

(*Continued on page 64*)

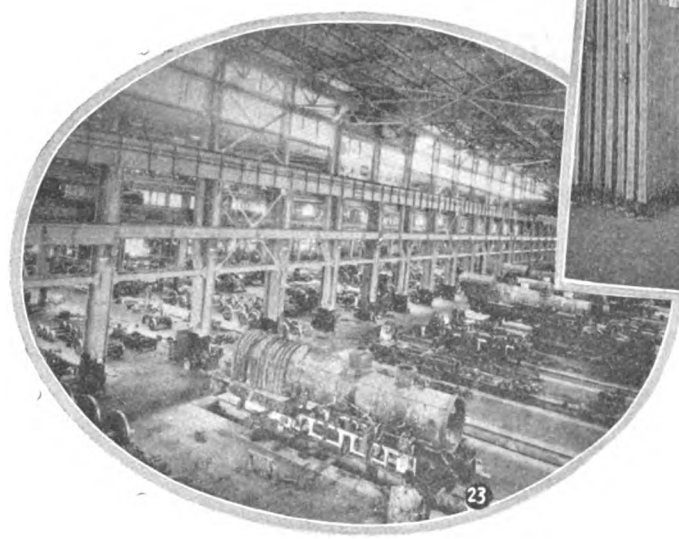


Fig. 23. In the photograph below, we again find the wood block floor under conditions which are exceptionally severe on any type of floor. The center bays in a wide one-story building can be effectively daylighted by a high monitor, as shown.



Fig. 22. The ordinary concrete floor would never stand up under such service as this, but special treatment gives concrete a hard surface so that these steel bed-frames make no impression on it. Notice the sprinkler pipes, painted a different color than the ceiling.



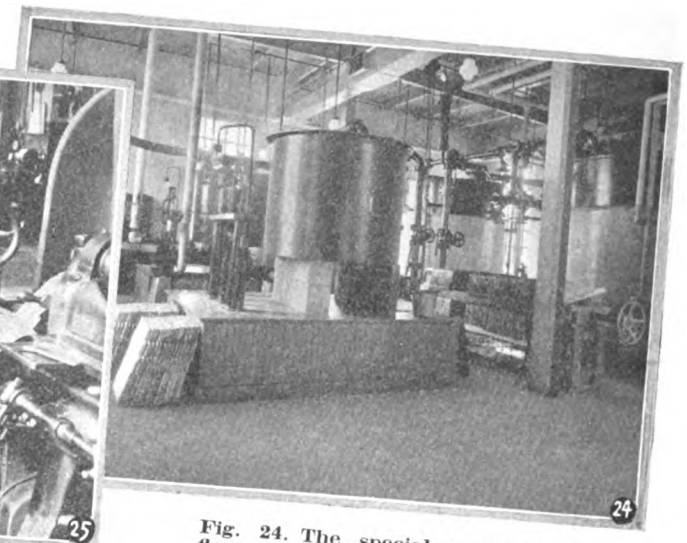


Fig. 24. The special composition floor in this case has to withstand the attack of chemicals—in the laboratories of the E. I. duPont de Nemours Company. Exposed piping, etc., in such cases can be protected by acid-resisting paint.

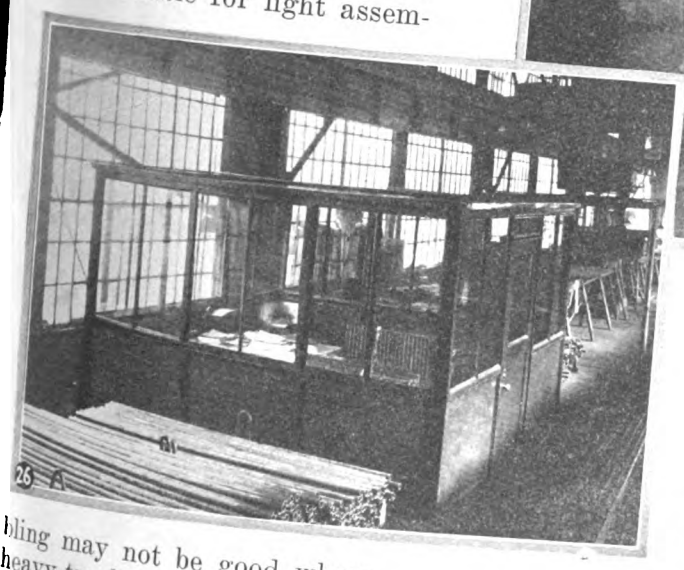


Fig. 25. Clean floors, nowadays, are within easy reach without the back-breaking work of scrubbing them by hand. A good motor-driven scrubber with a good cleaning compound makes short work of the job.

Fig. 26. A comfortable, well-lighted, steam heated office, without the necessity of heating an entire building. This is only one of the possible applications of modern partitions.



Fig. 27. Properly installed and maintained sanitary epuipment has come to be recognized as a highly important factor in production. The drinking fountain at the left has a compartment for ice.

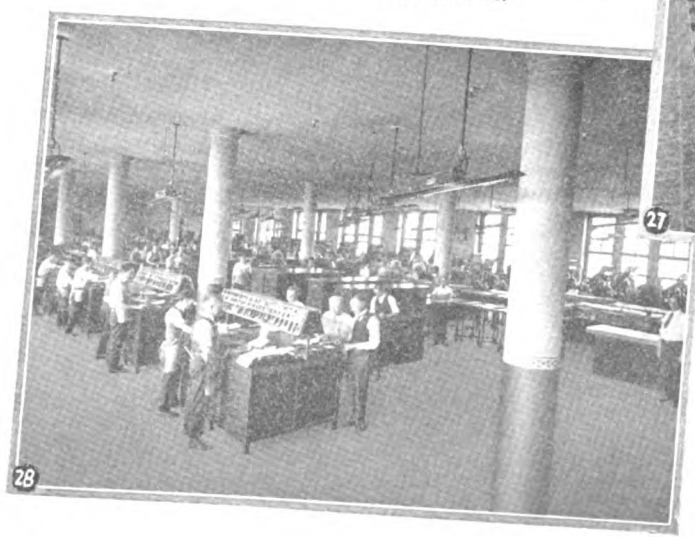


Fig. 28. Here we have a wear-resisting composition floor, perfectly smooth; light-reflecting paint on the ceilings and walls; and a dark paint dado on the lower surfaces where finger marks would show.

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Watching the Pulse of the Power Plant

Not Merely Keeping it Running—but Keeping It from Running Down— Is the Problem

By James T. Beard, 2nd

WE are told that the Chinese pay their physicians for keeping them well. As soon as they get sick, the doctor's pay automatically stops. Let that thought sink home and then ask yourself if, after all, the Chinaman is so many thousand years behind the rest of the world. Is he not in that respect a few steps ahead of some of his so-called more progressive neighbors?

Analyzing this relation between the Chinaman and his family doctor, just what is the physician's function in the eyes of his patient? What is his *raison d'etre?* Merely this; to keep him well, to make him better able to do his daily work, and to increase his days of usefulness as a producer.

We are not prepared to say how much truth is in this description of the Chinese attitude. But we do say that, if it is true, we who play with power plants in America may well look to the Far East for a worthy example.

An operating engineer, worthy of the name, stands in much the same relationship toward the power plant under his care as does the Chinese physician toward his patient. One of his duties is to run the plant. But the watch engineer can do that. Even the oiler could do it in a pinch.

If the chief is on to his job, his big duty is to keep that plant in a healthy condition. Not to be chasing around with a Stillson wrench in one hand and a large wad of waste in the other, with the beads of perspiration standing out on his grimy forehead, while he runs here and there, putting new valves in the feed pump, patching up this boiler or that engine and hoping that he can get through the day without a mishap.

Sometimes we find him doing these things, but they are not

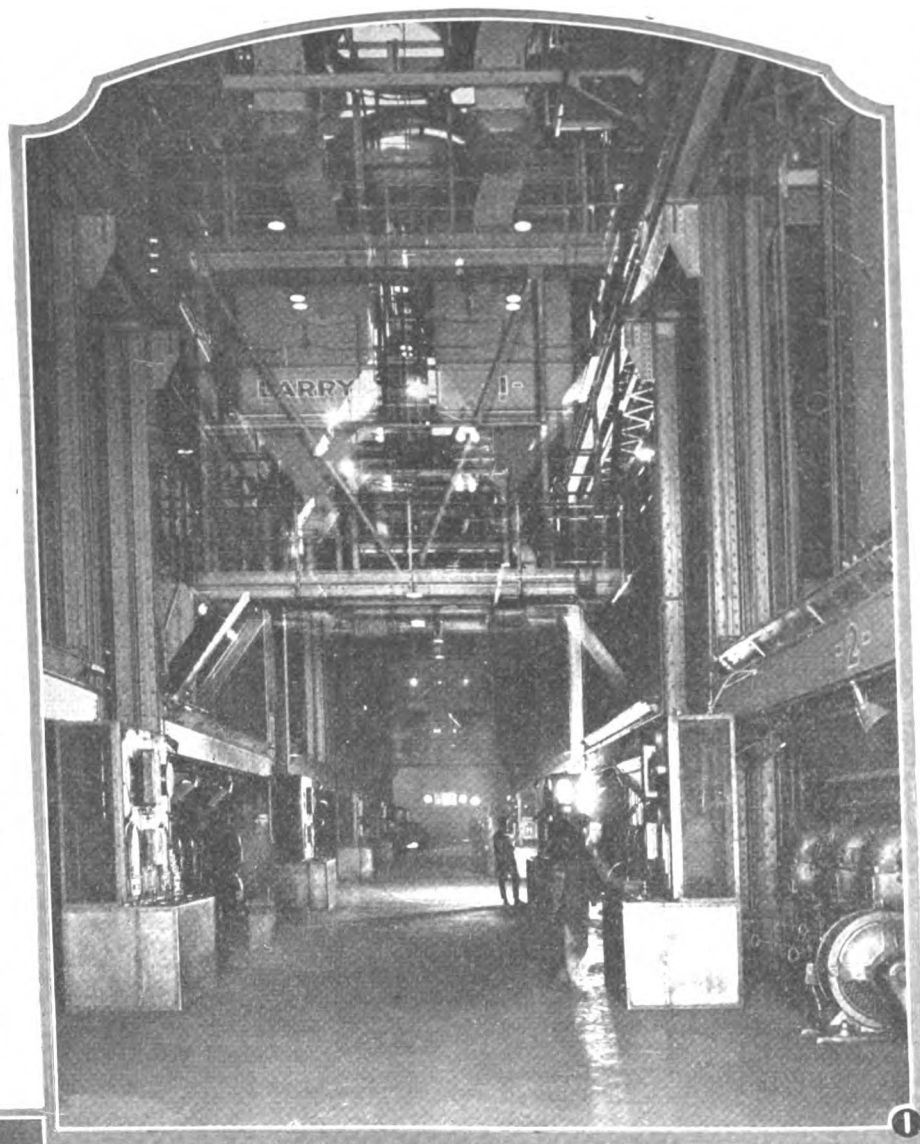


Fig. 1. Due to the severe service to which boiler house equipment is subject, maintenance becomes a vital factor in the operation of the plant. The life and safety of the boilers depends upon the inspection and care they receive, and the repair and operating costs of the auxiliary equipment is determined by the amount of attention that is given to it.

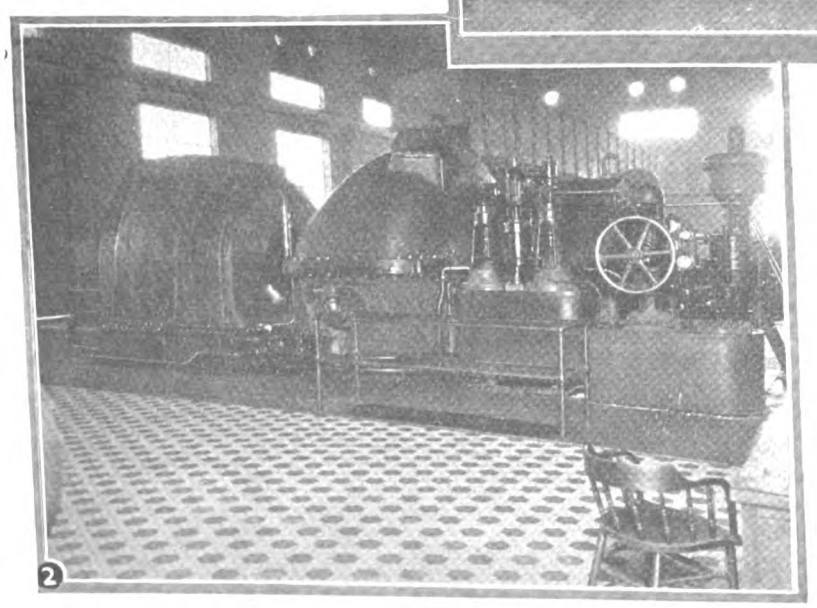


Fig. 2. Large turbo-generators are usually vital units in those plants where they are used. Any shutdown of such equipment seriously affects the entire pant. When they are propery inspected and a full supply of lubricating oil is assured to all parts, they are the smoothest runninp units in the plant.

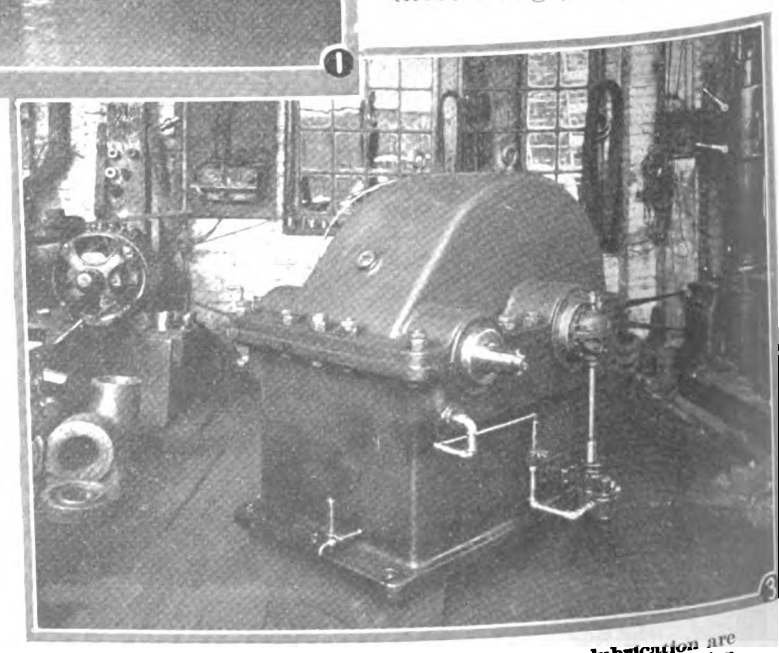


Fig. 3. Correct alignment and proper lubrication are vital factors in the smooth operation of reduction gear sets, whether they are used in connection with steam turbines or elsewhere. They should run with a minimum amount of noise, since noise means excessive wear and repair costs.

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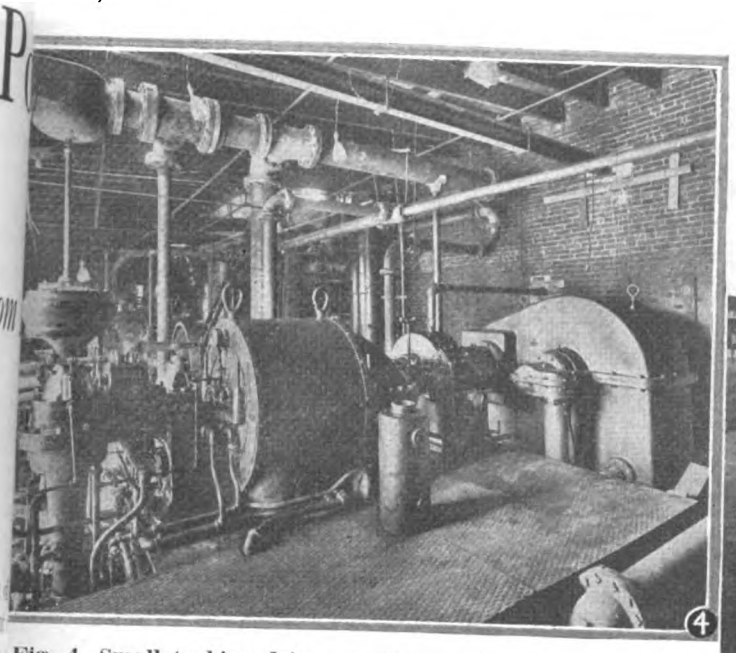


Fig. 4. Small turbine drives are frequently used in driving individual main units in the plant. The illustration shows a steam turbine connected to a beater engine in a paper mill. Naturally lubrication is the most important factor in the smooth operation of these units, but leaky packing glands cause unnecessary steam and power losses and result in a "messy" floor.

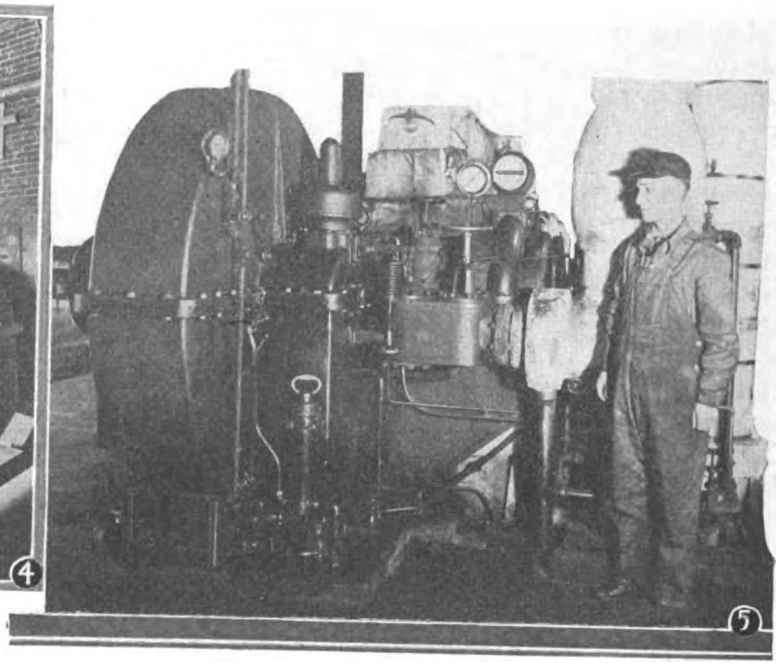


Fig. 5. The gages of a steam turbine are warning signals and should be carefully watched by the operator. The instant an unusual condition is indicated, the cause should be hunted down. Neglect may result in expensive repairs and shut-down of the unit.

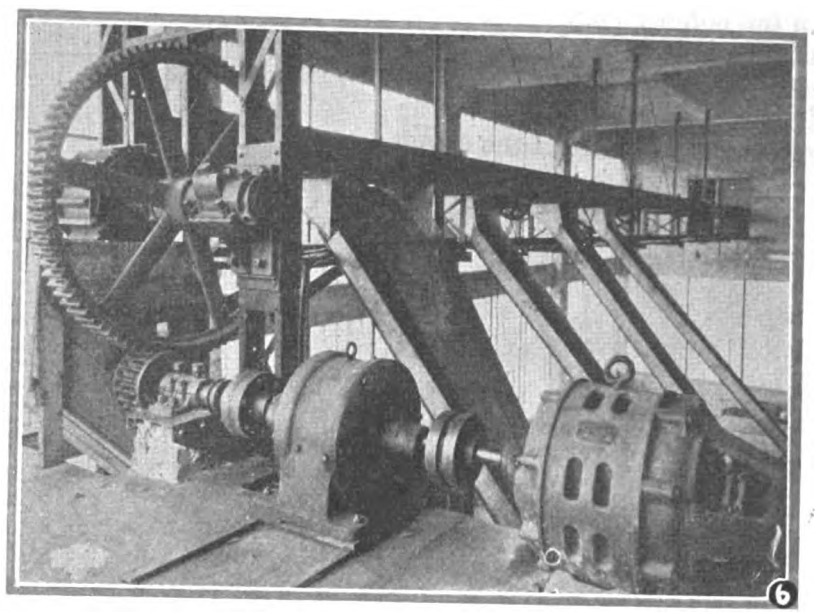


Fig. 6. Coal conveyor drives are usualy located in an out-of-the-way place. As a result, they may often be neglected until the conveyor is shut down. Regular inspection is vital.

job. We like to think of as our "prevention ex-," the man who keeps ble out of the plant, the who anticipates weakness is equipment and forestalls kdowns and expensive re-s. In short, he is the man spells maintenance with a tal "M"; he believes in nd he practices it. He ws that, even through his records show small in-ases for maintenance, these eases are like so much in-ance against expensive re-s later and a possible shut-n of the mill.

Maintenance is *prevention;* airs are *medicine.* And we er did like medicine. The pose of power plant main-ance is to maintain a high ndard of operating econ-y, to insure dependable and able service of the equip-nt, and to prolong the life the machinery investment. pairs are the result of ac-ent, inadequate or unintelli-gent maintenance, or unsuitable operating conditions or equipment. At best they are mighty poor substitutes for proper maintenance.

Take the case of your automobile, for example. Your instruction book gives you a chart, telling where and when to oil the various parts and how much oil to put in. It's a mean job at best and is frequently neglected. The result is a gradual wear and tear on the engine, the transmission or in the differential, carbon deposits on the piston and behind the rings, broken rings or

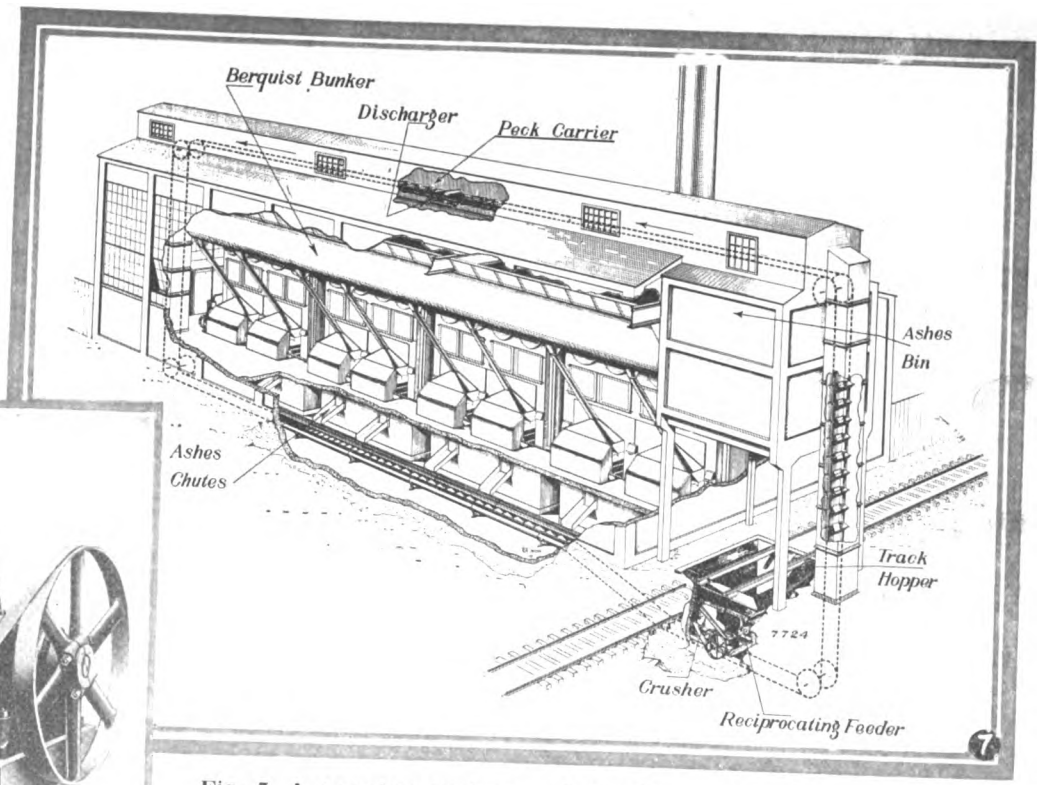


Fig. 7. A complete modern coal handling system is shown in this illustration. Such equipment is designed to stand the rugged service demanded of it, but neglect or lack of regular inspection may result in trouble, particularly at the crusher. Belt troubles may be due to poor alignment or to rock, iron, etc., getting into the crusher.

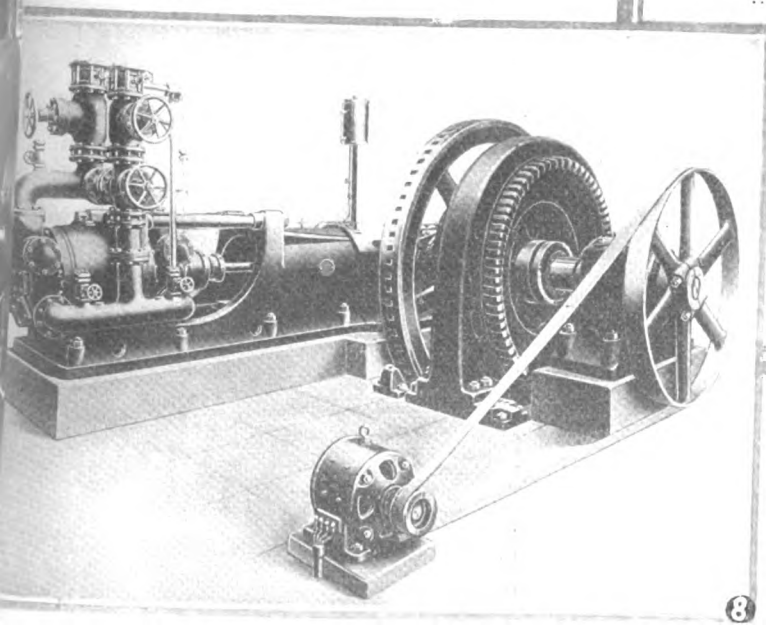


Fig. 8. Motor-driven units are numerous in manufacturing plants today. The illustration shows an ammonia compressor direct connected to a synchronous motor. With such a prime mover, maintenance troubles are very small.

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scored cylinders. And then a big garage bill. Careful attention and a few gallons of the right oil would have prevented it.

All industrial equipment requires a certain amount of care and power plant equipment, especially. Breakdowns are costly, even if they do not shut down the mill. It is not too much to say that the majority of breakdowns can be prevented by periodic inspection of the main and auxiliary units in the plant. But such inspection should be competent and thorough and at regular intervals.

The service of the equipment in the boiler room, particularly of the boilers and stokers, is severe. High ratings at peak loads, naturally have a telling effect upon the life of the steam

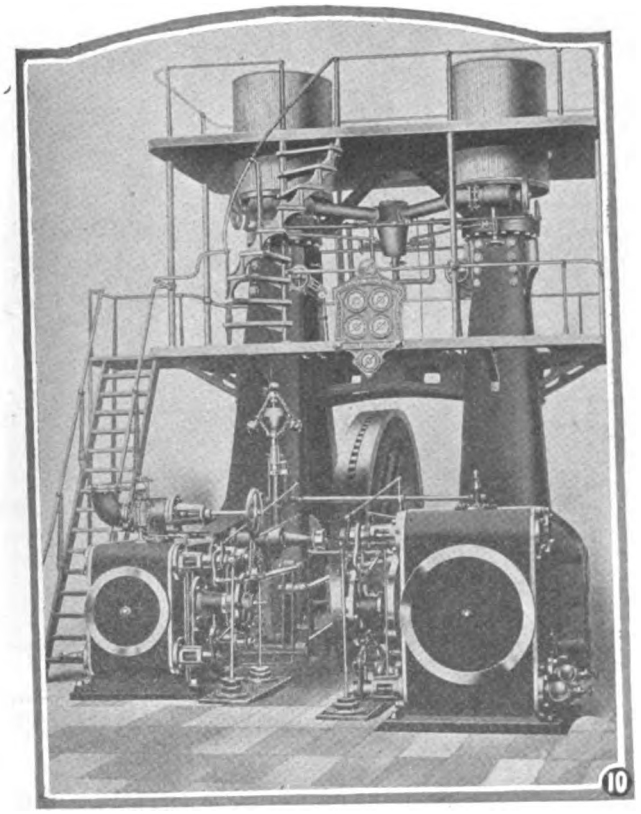


Fig. 10. The illustration shows an ammonia compressor driven by a compound Corliss engine. One of the most important points in the operation of such units is the tightness of the lantern packing gland of the ammonia cylinders. Leakage of ammonia is obnoxious and dangerous.

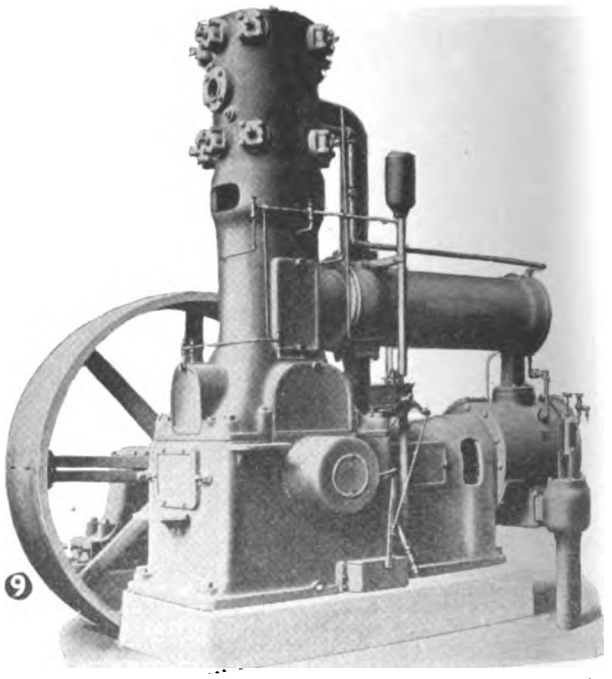


Fig. 9. The majority of industrial plants have some use for compressed air, and air compressor troubles have been numerous. Explosions in compressed air systems are costly and dangerous. These explosions can be prevented by assuring a clean intake of air and reducing the feed of lubricating oil to just what is needed.

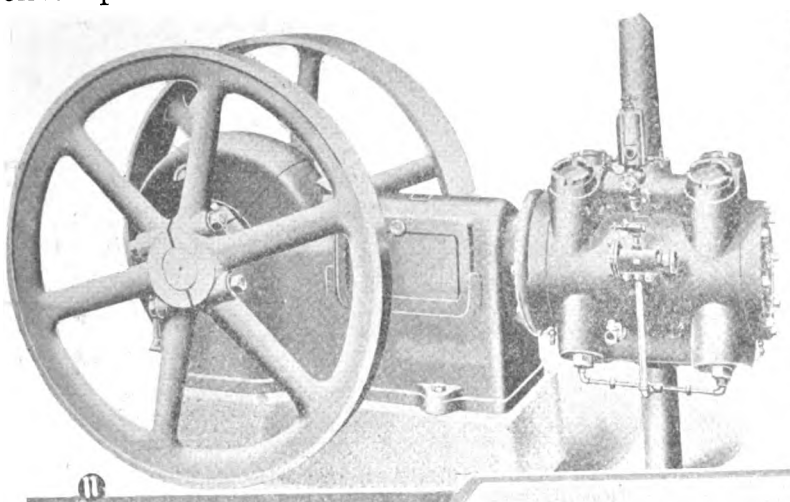


Fig. 12. Poppet valve engines usually give a minimum of valve trouble. Under the influence of high superheats, however, impurities in the steam or an over-supply of cylinder oil may bake on the valve seats or valve stems, causing faulty seating or sticking. When inspection shows these troubles have developed, steps should be taken to prevent their interference with the smooth operation of the unit.

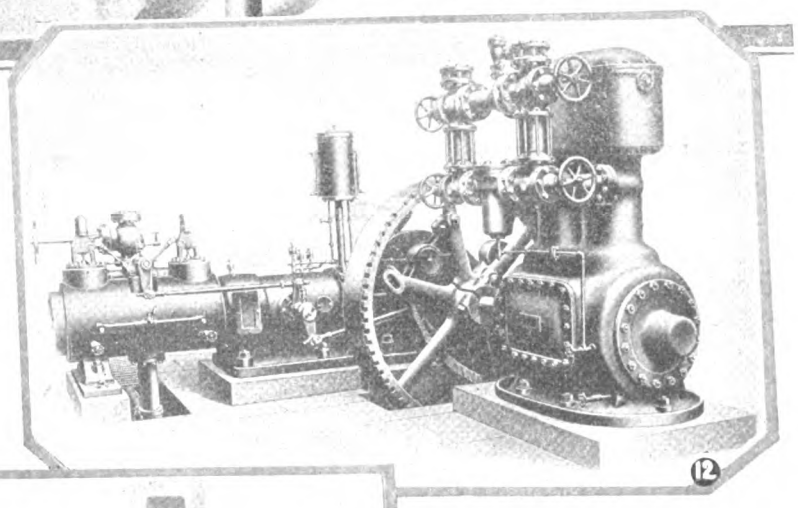
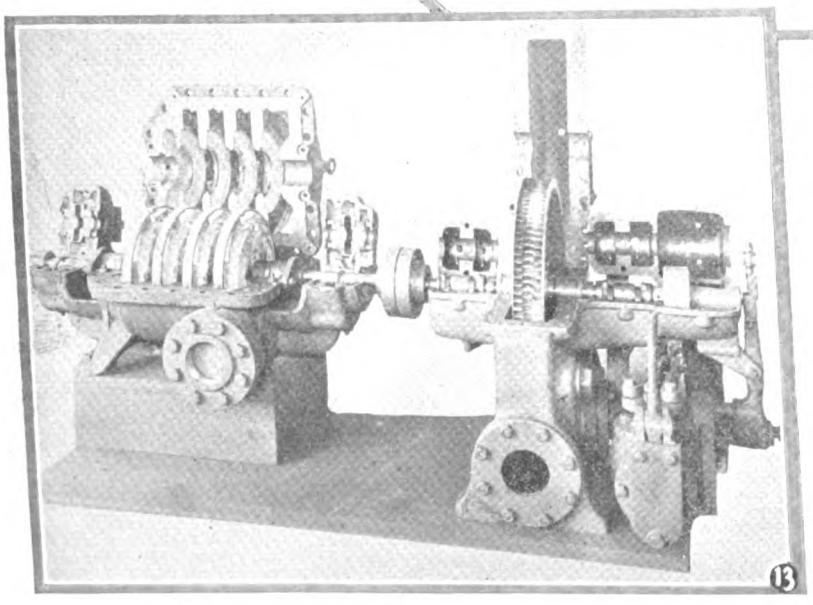


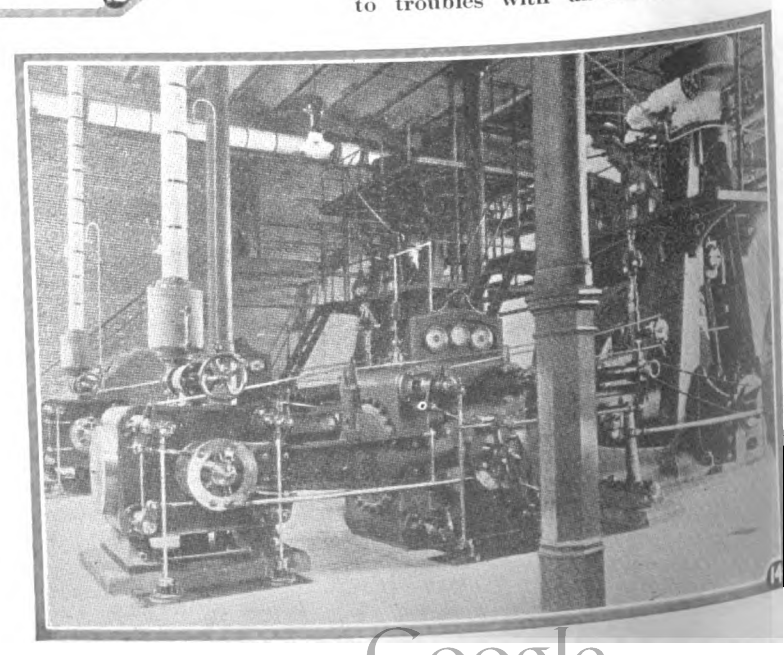
Fig. 11. When air compressors are over-lubricated and are supplied with dusty intake air, the valves become coated with a thick deposit which may harden and prevent proper functioning of the valve. These sticky deposits also collect in pockets in the air line and provide a contributory cause to dangerous explosions.

Fig. 13. In this illustration the upper casing of a steam turbine and boiler feed pump have been removed for inspection. Such units demand carefu attention.



generating units. One of the chief sources of boiler troubles is from scale, due to lack of treatment or improper treatment of the feed water. But, treatment or no treatment, all boilers must be cleaned at regular intervals, at which time necessary repairs to the brickwork and setting may also be made. It is, therefore, essential that there be a sufficient number of spare boiler units, so that each may receive its proper attention and cleaning in its regular turn. The writer has seen plants with two 500-horsepower boilers, where the normal load was too much for one boiler, but was not enough to demand the full capacity of both boilers. Such plants are not only uneconom-

Fig. 14. Engine room in a typical refrigerating plant. Frequently Corliss valve gear will run noisy due to faulty adjustment or other causes. Although noisy operation is not necessarily uneconomical, it is undesirable, since it may lead to troubles with uneconomical results.



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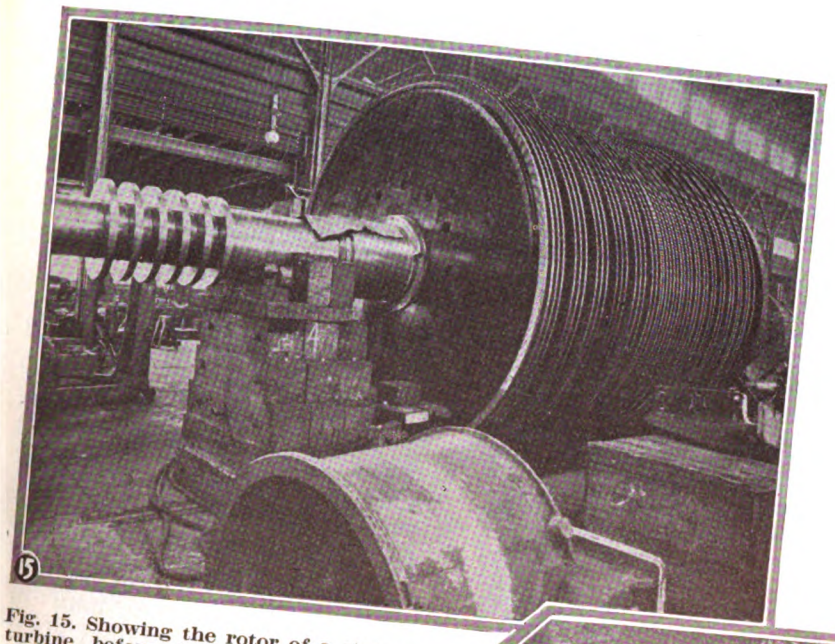


Fig. 15. Showing the rotor of a steam turbine before it is placed in its casing. The importance of a continual supply of lubricating oil to the thrust bearing of such turbines should be emphasized.

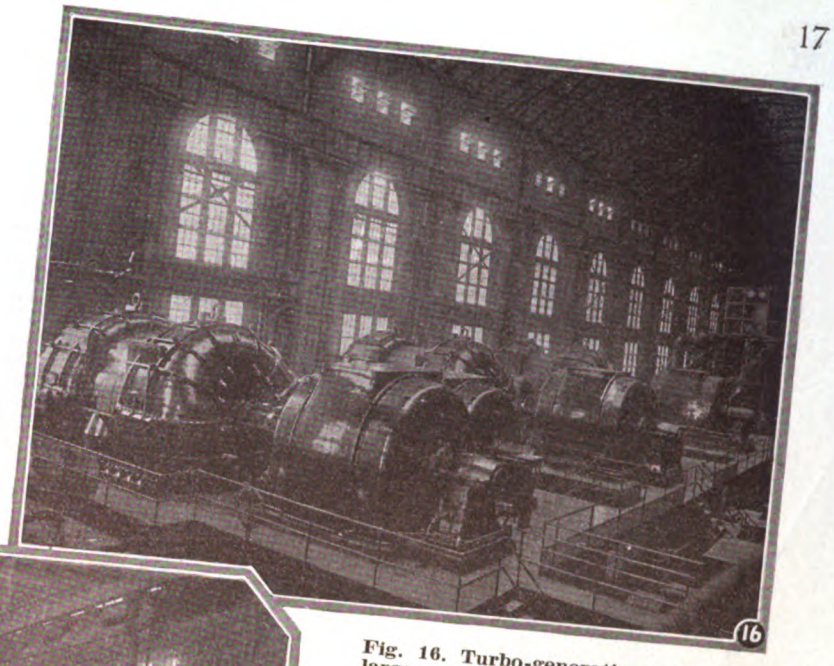


Fig. 16. Turbo-generating units in a large central station in the East. The sensitiveness of such equipment to automatic control is a distinguishing feature of its operation, and all parts must, therefore, be maintained in proper, smooth working order and adequately lubricated.

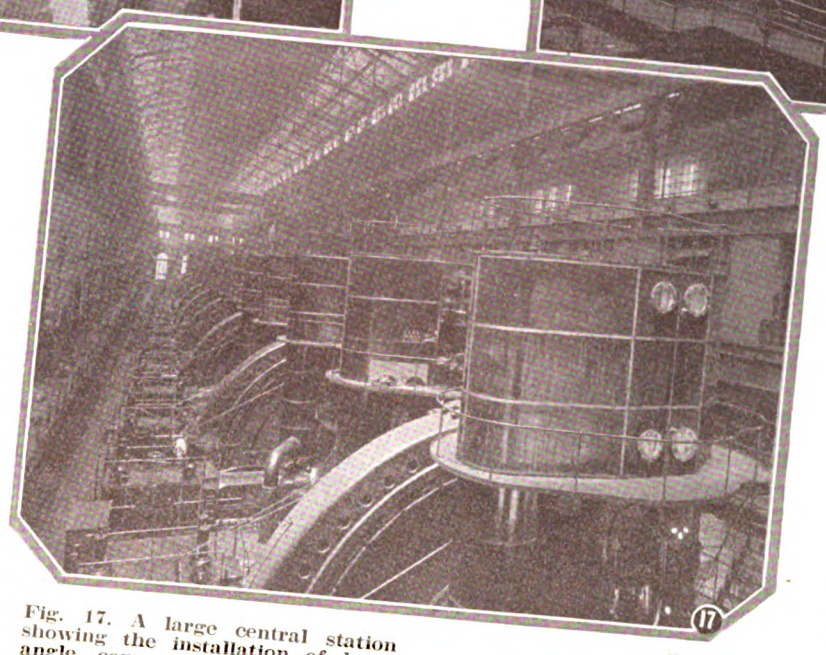


Fig. 17. A large central station showing the installation of large angle compound Corliss engines direct-connected to electrical generators. Maintenance and repair costs in such stations are usually kept at a minimum by constant and thorough supervision and inspection.

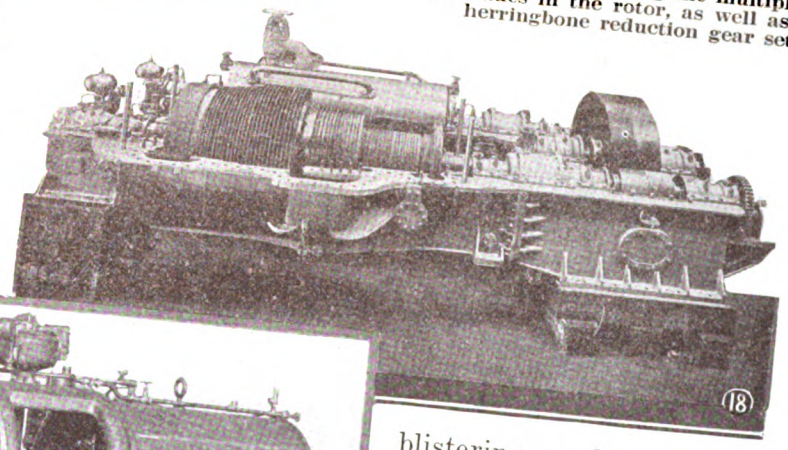


Fig. 18. A large multi-stage geared turbine unit with the upper casing removed and showing the multiplicity of blades in the rotor, as well as the herringbone reduction gear set.

ical, but it is impossible to give proper attention to boiler cleaning, since both units are required to supply the week-day load.

In plants of moderate size, it is good practice to have at least two spare boilers. One boiler is always down for cleaning and general overhauling and another is in reserve for emergencies. Where feed water treatment is inadequate and the formation of scale is rapid, it may be advisable to have more than two spares, so that proper attention to cleaning can be given.

Neglect of internal and external cleaning of boiler surfaces causes excessive heating and strains in the boiler structure and may often result in blistering or bagging of the boiler metal and possibly even a blown out tube or boiler explosion.

There is no definite rule as to the frequency of cleaning. That depends upon the plant conditions, the character of the feed water. Scale must not be permitted to accumulate, however, since it not only prevents economical operation, but lessens the capacity and life of the boiler and introduces an element of danger in the otherwise safe operation of the plant.

Furnace maintenance and the maintenance of arches is closely associated with the operation of the plants and the control of the draft and fires. Furnace repairs result largely from improper operating con-

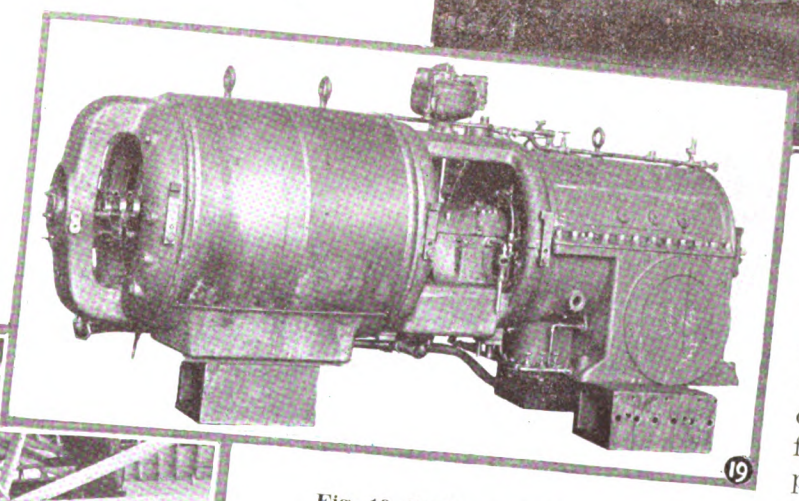


Fig. 19. Turbo-generator units rigidly mounted upon the same bed plate and direct-connected seldom give much trouble due to misalignment. Lubrication remains a vital factor due to the high rotative speeds, and the gages should be carefully watched at all times.

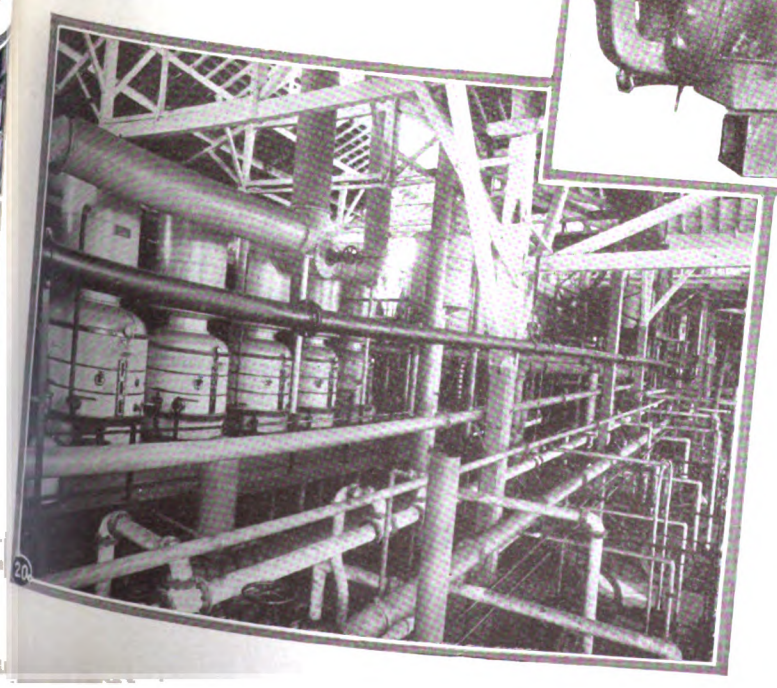


Fig. 20. Maintenance of pipe lines is a large item in many plants where they form the labyrinth of devious paths for water and steam, as indicated here. Tight joints and valves and adequate insulation are necessary to economical operation.

(Continued on page 76)

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Good Lighting

By M.

Director, Laboratory of Applied Science, National



Fig. 1. The windows behind this operator are useless, owing to years of neglect. They are practically opaque, due to the collection of carbon scale, etc.

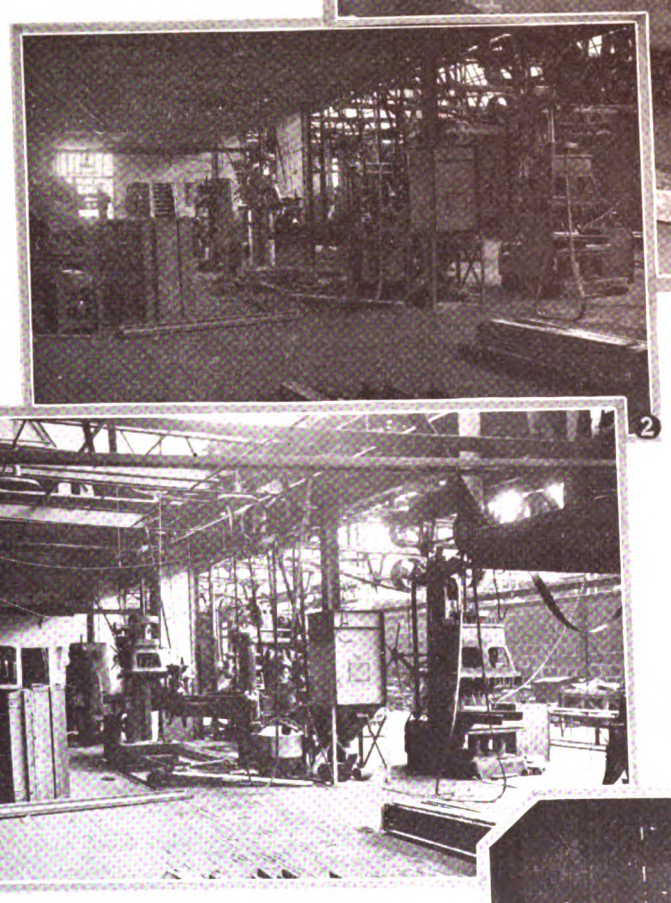


Fig. 2. Before cleaning the glass. See Fig. 3.

Fig. 3. After cleaning the glass. Compare with Fig. 2. The photographic exposure was the same as that for Fig. 2.



Fig. 4. The daylighting has become almost zero owing to neglected glass areas. The illumination intensity was 0.7 foot-candles.



Fig. 5. The condition of Fig. 4 was barely improved with the very poor artificial lighting.



Fig. 6. The windows shown in Figs. 4 and 5 were cleaned with a good cleaning compound. The result is obvious. The illumination intensity increased from 0.7 foot-candle to 15 foot-candles.

In this highly artificial age we cannot escape the fact that our working and living conditions differ in many respects from those under which mankind evolved through countless thousands of years. The human race was born in the natural world completely subject to Nature. What distinguishes primitive man in the ranks of the animal kingdom is his tendency to construct an artificial world by using the secrets which he wrested from Nature. It is true that animals possessed the instinct of self preservation and as a consequence burrowed into the ground for shelter or otherwise provided protection. However, certain animals gradually went further and used fire, developed weapons, and used tools. These started on the pathway to present civilization, leaving all other animals far behind in the struggles of countless ages.

In order to account for many of our characteristics we must go back in our imagination to the environments through which the evolution of mankind passed. Light is one of the primary essentials to life as we know it. The great natural illuminant throughout the ages has been daylight. To its quality or color the visual process is best adapted, for we cannot avoid the acceptance of the fundamental principles of evolution. To its distribution the retina and physiognomy adapted themselves.

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and Prosperity

LUCKIESH

Lamp Works of the General Electric Co.

The light came from above—from the sun and from the sky—and the forehead projected to form protection from the glare. Today we still feel the effects of those countless centuries of adaptation because light from below the horizontal is more glaring and discomforting than light from above.

We must also consider the quality of daylight. The sun contributes most of the daylight which reaches the earth's surface outdoors on a clear day. On such a day the sky contributes about 15 to 20 per cent. usually. It is the most natural consequence that the light reaching the earth outdoors from sun, sky, and clouds should appear colorless to us and that our standard illuminant for color discrimination is average daylight. The color of an object is not merely inherent in the object but depends largely upon the illuminant. For these reasons it is easy to see why daylight is a standard illuminant for mankind. If the illuminant had any other characteristic the visual factors would adapt themselves to it if the period of adaptation extended over a sufficiently long time, which doubtless is a matter of centuries at least.

Now let us come indoors as mankind did for a portion of the time at least. Coming indoors imposed certain other influences. The light reaching indoors from openings in walls

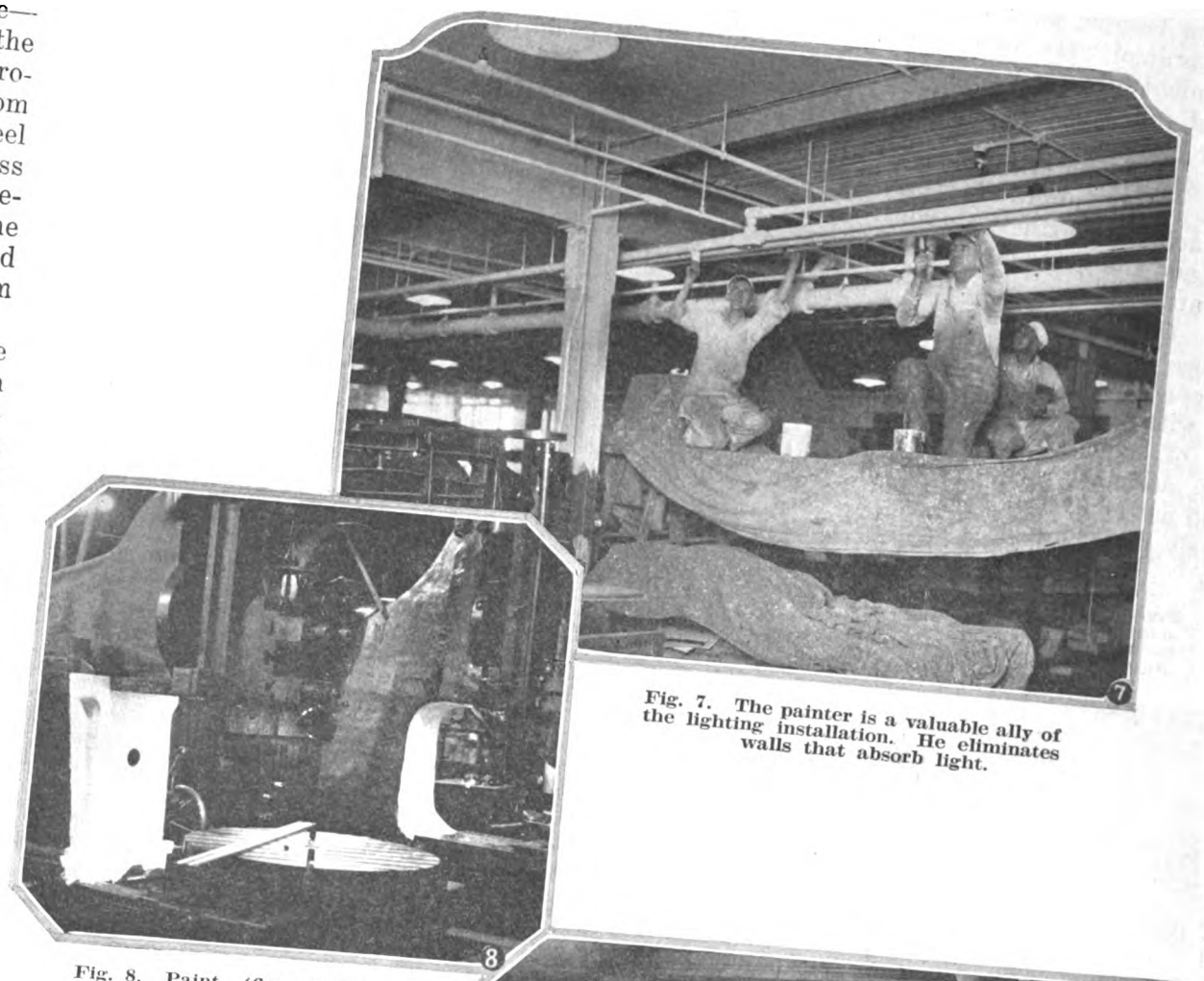


Fig. 7. The painter is a valuable ally of the lighting installation. He eliminates walls that absorb light.

Fig. 8. Paint (flat white) aids diffusion, increases the amount of light on the work, and reduces glare.



Fig. 9. A lamp factory believes in its own product. It uses a high intensity of general lighting and many lamps for localized lighting where very high intensities are desired.



Fig. 10. The forest of belting as found in this screw-machine room, does not prevent an adequate supply of properly diffused lighting reaching the work from the overhead system.

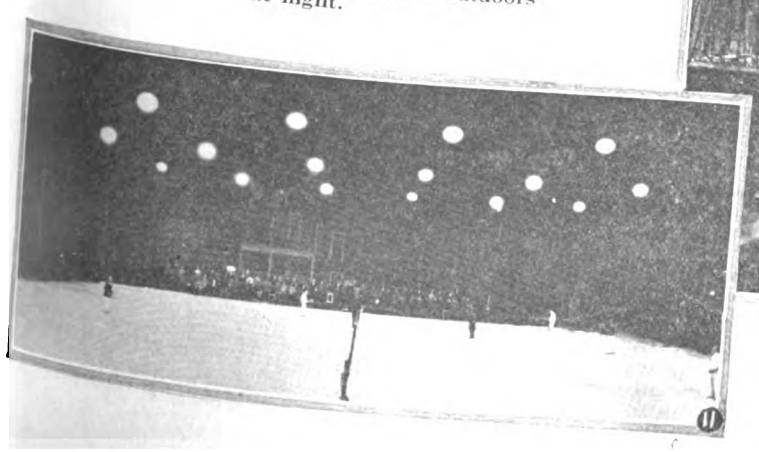


Fig. 11. Employees play tennis outdoors at night.

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was now chiefly skylight. On a clear day this is a bluish white light and on a cloudy day it is more nearly white. Fire was one of the chief reasons why man became partially an indoor animal. He was now independent of Nature when daylight failed. Owing to the meager light obtainable from burning crude materials his activities after nightfall were slackened. Nevertheless, this fire made the home-circle possible after the day's foraging. Thus, the light from flames has become a natural illuminant ever associated by mankind with the security and comfort of home. However, the long adaptation to daylight could not be overcome in a relatively few centuries and daylight is still the best quality of light for vision of the completest character.

On coming indoors mankind imposed certain restrictions on daylight. The tremendous intensities running as high as 10,000 foot-candles at noon on a clear summer's day could not be brought indoors. Roofs, walls, adjacent buildings, structural requirements and growing congestion of building, have all combined to reduce the daylight intensities to a fraction of their outdoor value. When glass areas are not properly maintained or cleaned these restricted intensities are still further reduced and finally, of course, can reach zero. A great deal of work has been done in designing glass areas for buildings but a discussion of this phase is beyond the scope of this article. It is sufficient to state that the tendency is to consider the sky as the light-source and to exclude or to diffuse the direct sunlight. Incidentally, there is a general impression that oftimes we have too much light. That this is erroneous is easily proved by actual measurements. Outdoors we are subjected to an intensity of thousands of foot-candles during many hours of the day. Indoors under good daylighting conditions we seldom find a hundred foot-candles. Under poor daylighting and ordinary artificial lighting conditions we have an intensity of only a few foot-candles. When one suspects that there is too much light it is well to inquire into the manner of its use and into various visual factors, such as contrast, brightness of walls, diffusion of light, position of windows and lighting units, etc. The difficulty will be found among such factors. By considering the high intensities of illumination under which mankind has evolved and by studying physiological laws the conclusion is reached that illumination intensities, for both daylight and artificial light, are very often too small for the best working conditions. Of course, the solutions are adequate and proper glass areas well maintained and approved artificial lighting units properly installed and maintained. Although there is much still unknown in regard to light and human activities, enough knowledge is available to improve greatly all lighting

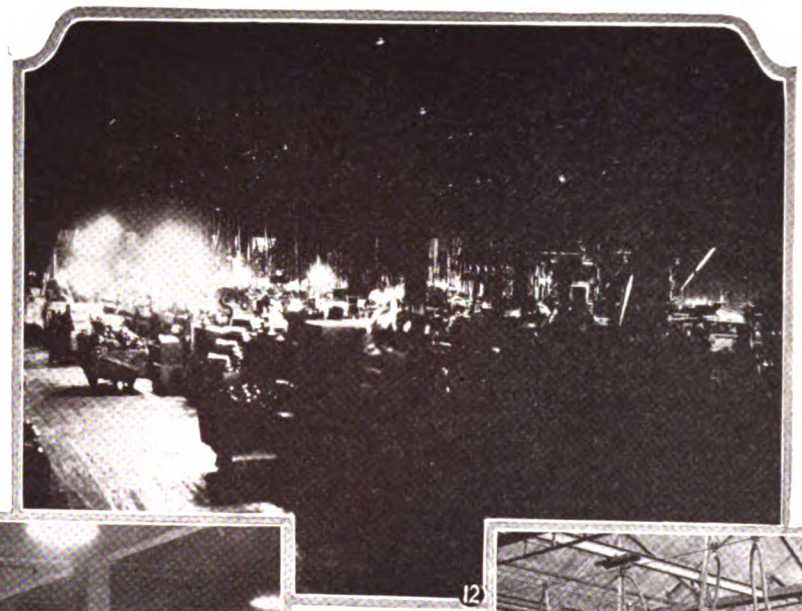


Fig. 12. This represents the actual condition in a certain factory recently. The average illumination intensity was 0.2 foot-candles.



Fig. 13. This represents the condition in the same room as represented in Fig. 12 after rehabilitating the lighting system. The average illumination intensity is now from 6 to 10 foot-candles. The management of this factory is highly enthusiastic over the possibilities of good lighting.

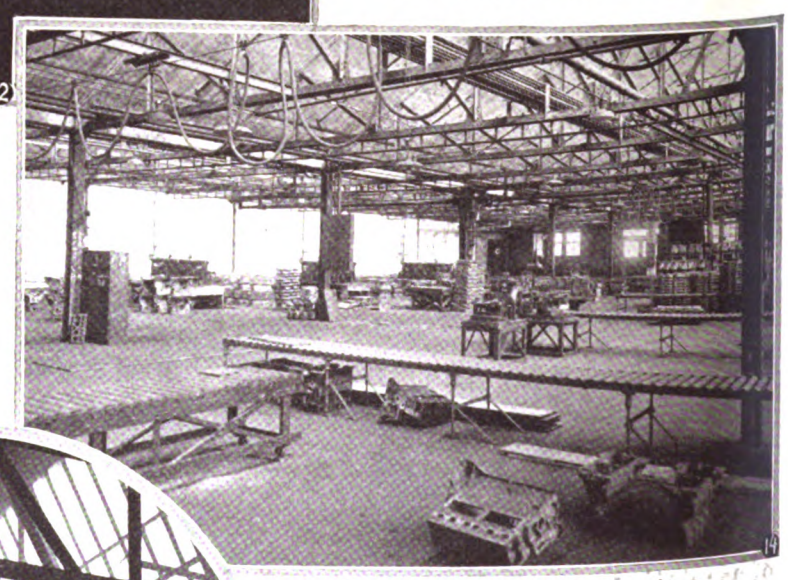


Fig. 14. Good daylighting in a factory.

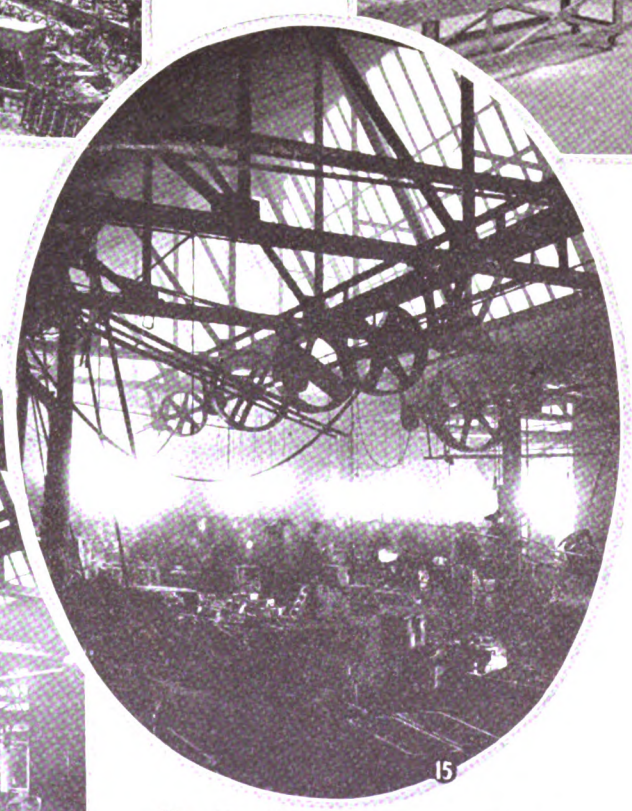


Fig. 15. Dirty skylights and poor artificial lighting.

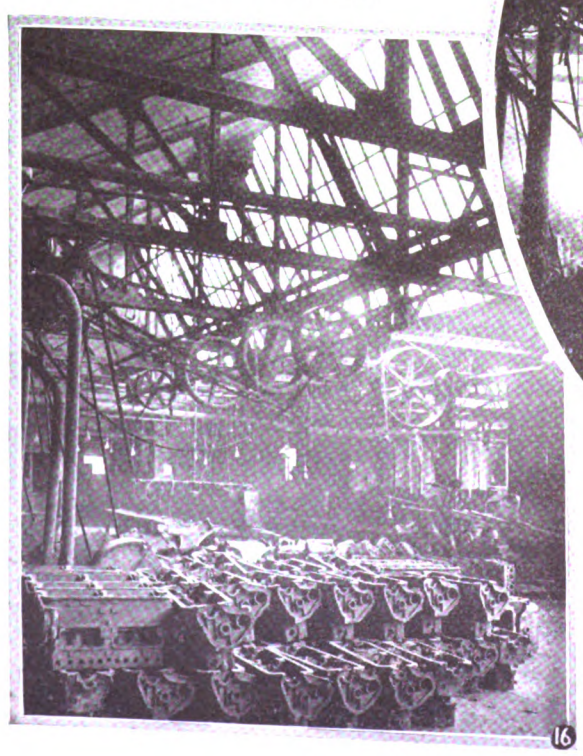


Fig. 16. The condition after the skylights were cleaned. Compare with Fig. 15. The two photographs had the same exposure.

(Continued on page 81)

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A Basic Industry in Our Biggest Territory

BY D. M. LE BOURDAIS

ALASKA is a country of surprises, but perhaps nothing in that great land is so remarkable as the great strides with which the reindeer industry has advanced in the comparatively few years since its inception. Most of us are more or less familiar with the reindeer from infancy; for has not Santa Claus always driven a bounding team of them throughout the land on frosty Christmas nights? But that, however, is about the full extent of our knowledge of this most interesting animal.

Yet there are millions of people in the world whose dependence upon the reindeer is absolute. In northern Norway and Sweden, in Finland and Lapland, and right across the northern part of Asiatic Russia the reindeer supplies most of the people with most of their needs. In the first place it supplies food—meat and milk; then its hide is useful for making clothes, tents and even boats; and, lastly, it is employed as a beast of burden, either driven in sledges or ridden.

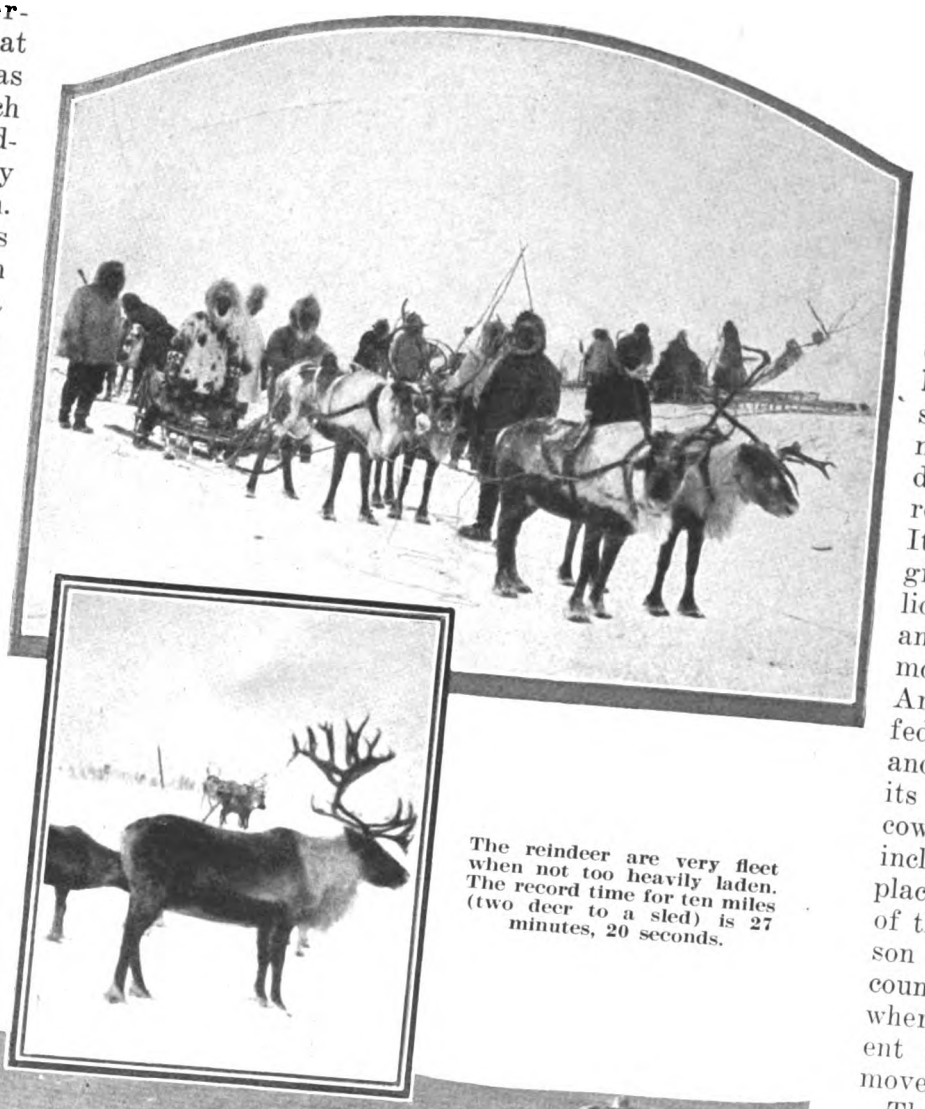
If you were to ask a scientist to describe a reindeer, he would be likely to answer somewhat as follows:

The reindeer is an antlered, herbivorous, graminivorous, ruminant ungulate, and a semi-migratory but gregarious animal, of the family Cervidae, the genus Rangifer, and the species Rangifer tarandus.

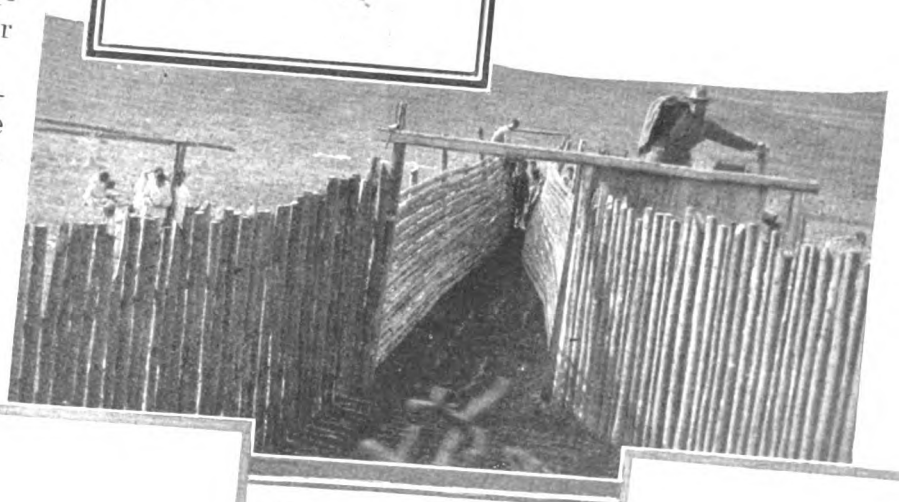
All of which would be quite true—at least that is the way Judge Lomen, of Nome, Alaska, has described it in an article in the "Journal of Heredity," and he was not joking either. But to get down to language which we all understand, the reindeer is an animal having antlers like most deer excepting that in the reindeer both sexes have them. It eats the rich grass which grows on the Arctic prairies, lichens, the foliage of low trees and bushes and the deep, thick moss which is a feature of the Arctic tundras. When it has fed it lies down in a quiet place and, like a cow or sheep, chews its cud. Also like a sheep or cow it has a split hoof. It is inclined to move about from place to place at certain periods of the year, spending one season in a certain part of the country and the other somewhere else, but with no apparent regularity; and when it moves it does so in large herds.

That is about what Judge Lomen meant when he said in a few long words what I have said at some length in more or less short words. I might also have said that a full grown reindeer is about four and one-half feet in height and about seven feet in length from nose to tail. In color it is usually

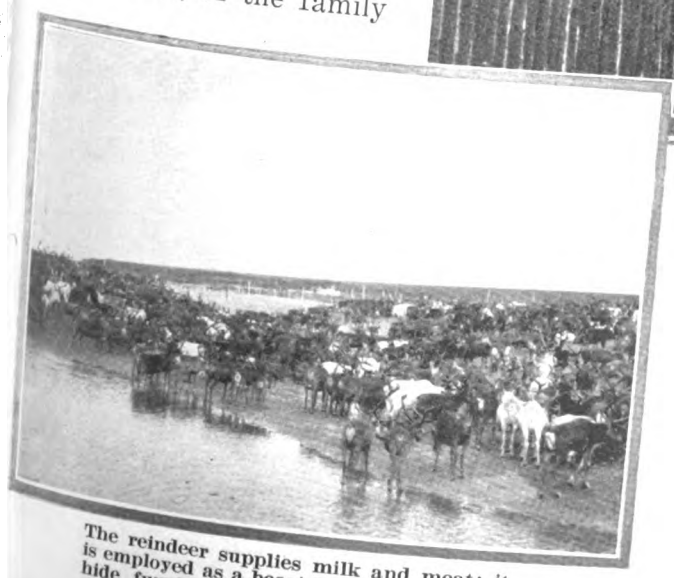
(*Continued on page 71*)



The reindeer are very fleet when not too heavily laden. The record time for ten miles (two deer to a sled) is 27 minutes, 20 seconds.



The reindeer are driven through chutes such as the above, being marked for identification as they pass through.



The reindeer supplies milk and meat; it is employed as a beast of burden; and its hide furnishes clothes, tents, and even boats.



Reindeer in a typical summer corral. Many people, incidentally, fail to realize that Alaska's summer climate rivals our own.

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Making the Factory Ceiling Pay Dividends

Overhead Conveyors and Their Many Uses

BY MATTHEW W. POTTS



Fig. 1. Handling materials in foundries has always presented a difficult problem. Chain hoists, trolleys and monorails can be made to serve every foot of floor space.

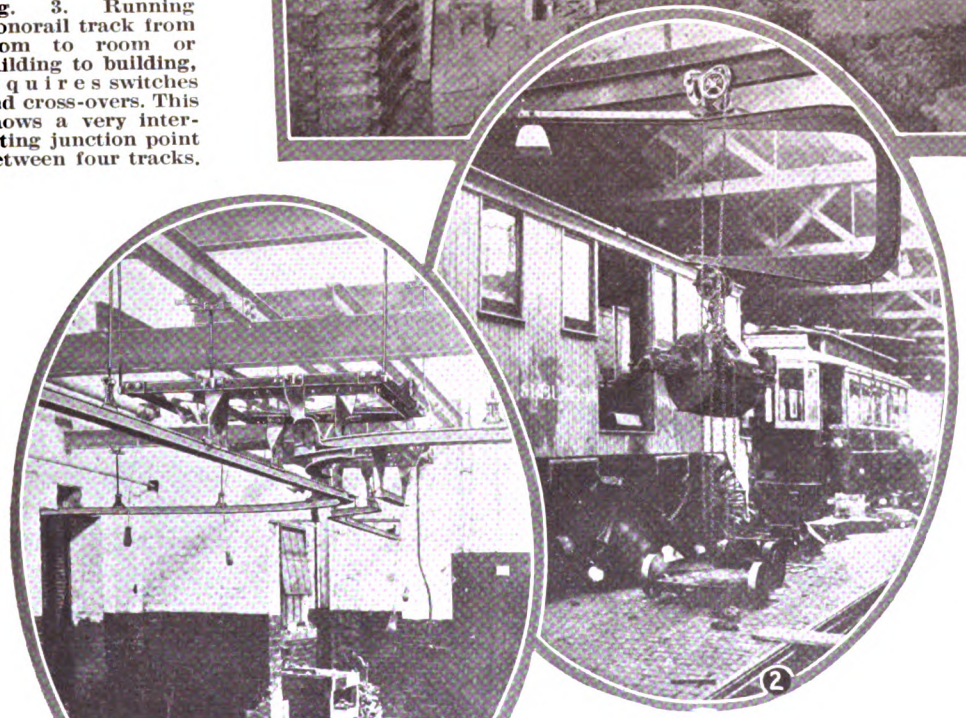


Fig. 3. Running monorail track from room to room or building to building, requires switches and cross-overs. This shows a very interesting junction point between four tracks.

Fig. 2. The method of supporting the hoist from the trolley should be given careful consideration. This shows how motors are swung in and out of snow plows and street cleaners in an electric railroad repair shop.

VERY little has been written on the subject of hoists, monorails and telphers, and there is considerable confusion and misapplication of the various terms. Frequently engineers and plant executives consider any equipment that travels on a single I-beam or special rail as a monorail, and they do not detail the equipment in their minds, but permit this confused idea to remain.

Hoists, monorails and telphers are so closely related that they might be considered as one piece of equipment, if there were not so many different types of each. For instance, there is in the case of simple chain hoists, the following classifications: Multiple spur gear, single spur gear, worm or screw gear, differential sheave, etc., but they are all commonly known as chain hoists. The same is true regarding monorails. There are many different makes and types of track, from simple I-beams to built-up sections, each having a trade name, and some not even mentioning that they are monorails.

In order to have the reader's mind clear on the terms used in this article, and in order to show the broadness of the subject, the following definitions will give the sense of the terms used herewith:

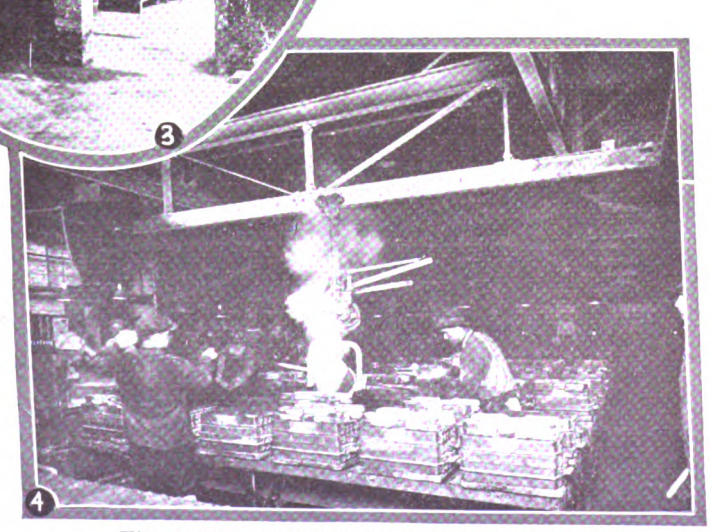


Fig. 4. This special hoist is supported from a trolley monorail and greatly assists in pouring the molten metal into the mould.

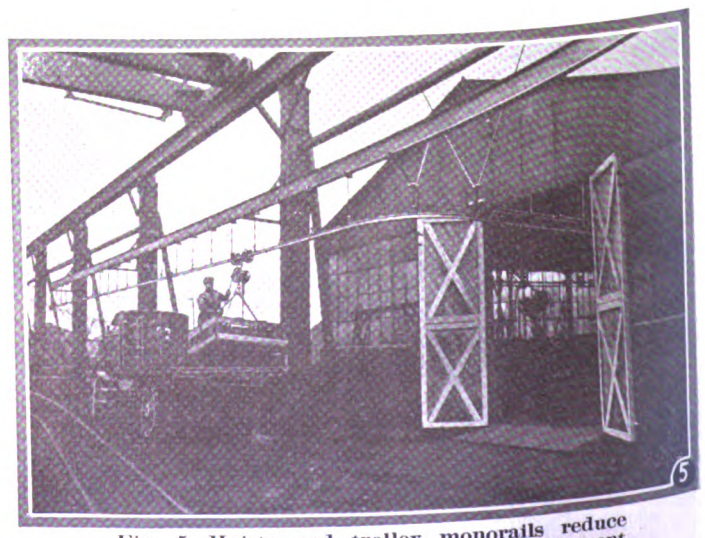
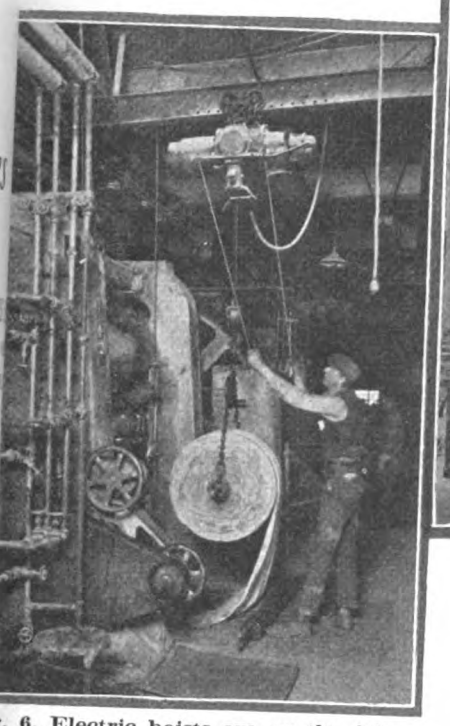


Fig. 5. Hoists and trolley monorails reduce costs in unloading heavy freight or equipment from motor trucks, steamboats, railway cars, etc.

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g. 6. Electric hoists are on the job hours a day, and can be operated a moment's notice. By being at-ched to trolley monorails they can be ade to serve more than one piece of equipment.

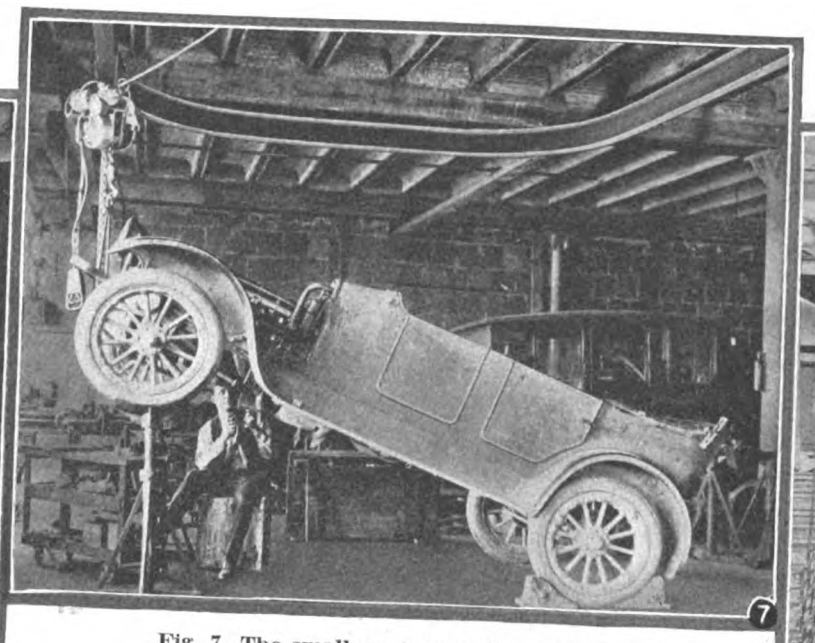


Fig. 7. The small pant, as well as the large plant, finds many uses for monorail equipment. Note adjustable stand and movable bench with tools to work with while under the car and blocks under rear wheels. This equipment reduced the time on jobs by 50%, and made the work light and convenient.



Fig. 8. The use of chain hoists and trolley monorails in this steel warehouse increased storage space 50%, as it was possible to pile the material higher. In addition, the loads are carried on a trolley and I-beam system from one to 50 feet.

Hand hoist (Includes all nakes and designs where he lifting force is ob-ained by the direct appli-eation and effort of man power.)

Pneumatic hoist (Includes all makes and designs where the lifting force is obtained by the direct application of the pneumatic principle.)

Electric hoist (Includes all makes and designs where the lifting force is obtained by the direct application of electric power.)

above hoists can be either e, rope or chain type, and classified under many de-d headings, but a general-ion is necessary in order implify the use of terms.

Monorails: (This term applies to all overhead carrying systems where only one rail is used to carry the load. This rail does not have to be a standard I-beam rail, but can be built-up or special section.)

Trolley: (This term applies to the use of a set of wheels for operating on a monorail, where man power is used or the wheels are propelled by a telpher.)

Telpher: (This term applies to a set of wheels for operating on a monorail, where either gas or

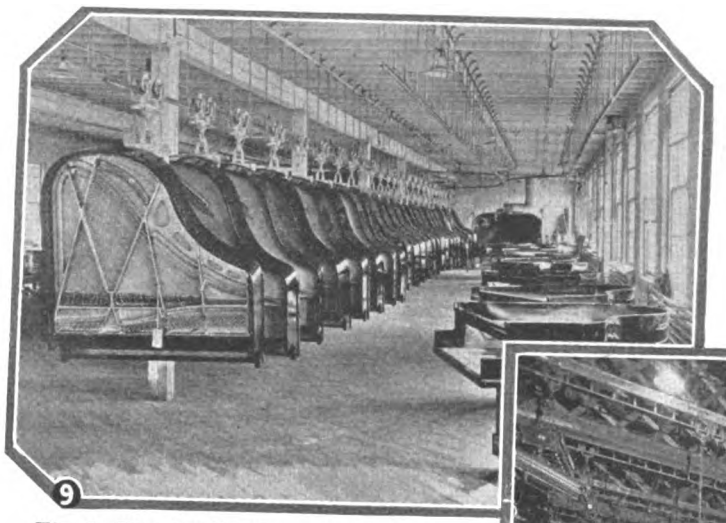


Fig. 9. The Apollo Piano Company have found trucking on the ceiling to be the most economical means of handling grand pianos. This view was taken in the varnishing department.

Fig. 10. Industrial plans are not the only users of overhead equipment. Even the movie industries have found it advantageous for shifting sets, and holding lighting effects.

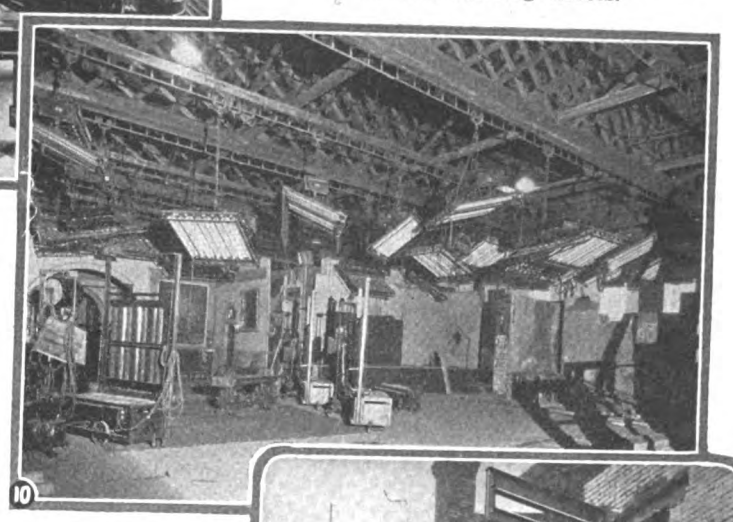
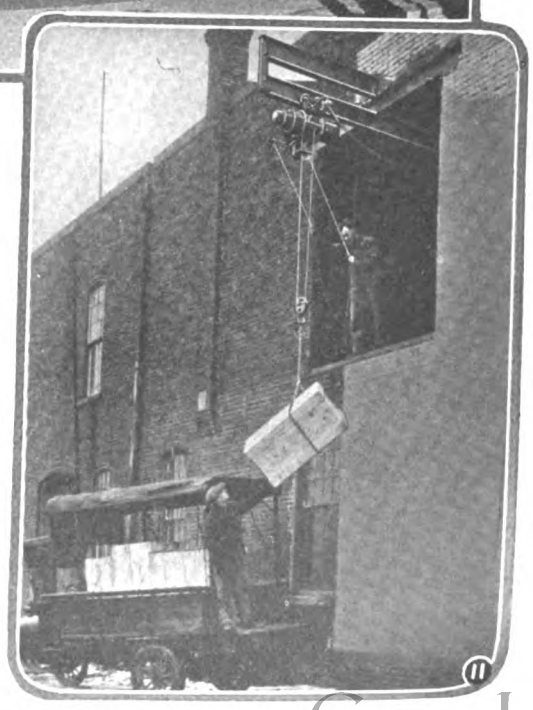


Fig. 12. Building contractors have found hoists and trolley monorails of great assistance in laying stone work and placing heavy beams on new construction.



Fig. 11. The electric hoist and overhead trolley monorail installed as shown on the right saved $2,200 on the initial investment, which would have been required for putting in a freight elevator.



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Fig. 13. Acid conditions in tanneries are hard on trucking equipment. The over-head monorail is out of the way and free from moisture.

Fig. 14. This is an installation in one of the largest mill supply houses in the country. Accurate records of operating costs show that the electric chain hoists and trolley monorails have saved the wages of four men previously employed in handling pipe at this warehouse.

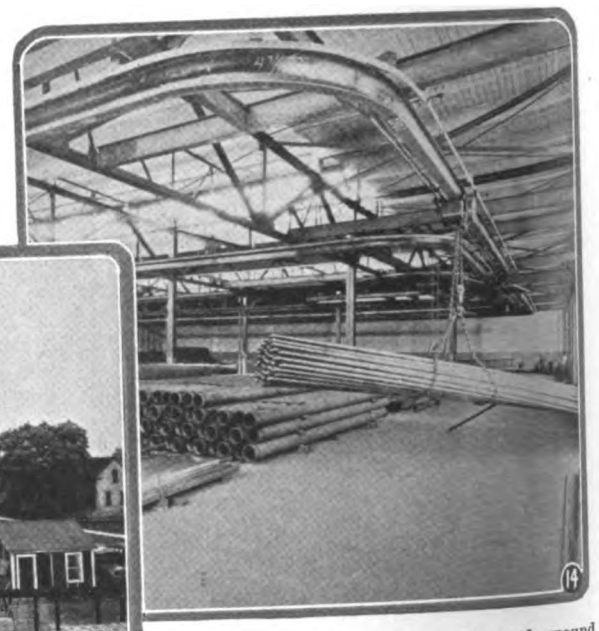




Fig. 15. Trucking over rough ground is difficult and roadways are expensive. Light duty monorail systems to feed the yard and buildings can be installed cheaply.

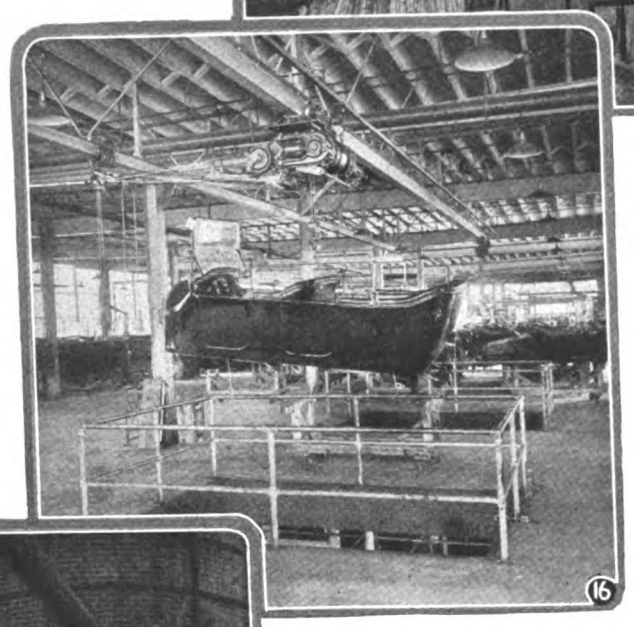


Fig. 17. The B-O-T pottery company, Trenton, N. J. use the over-head system of transportation throughout their plant. Notice the load that one man moves quickly, easily and without breakage. The canopy over the carrier is to keep dust and dirt from falling on the fixtures before they are baked.



Fig. 16. The hoist is one of the vital parts of the overhead conveying system. This hoist, with special controls is used for lowering finished bodies from second to first floor and on to a body conveyor.

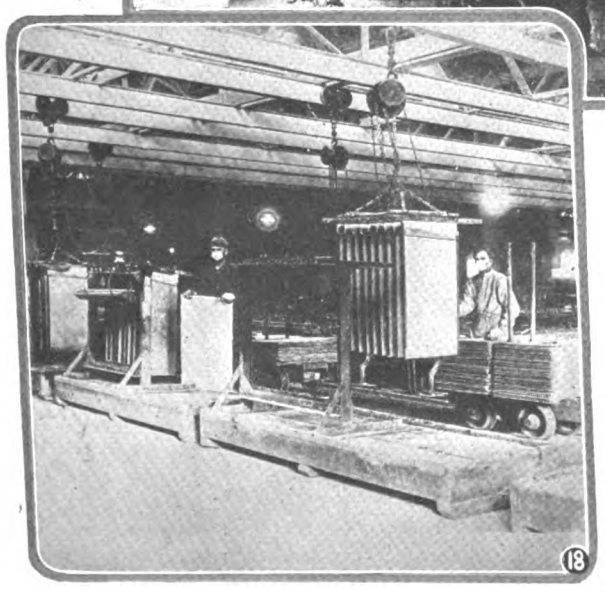


Fig. 18. Trolley monorails operating in the copper refining process where it would be impossible to handle this material with any other type of equipment.

electric power is used to move the telpher, and telphers will be known under two headings as plain telphers or cab-operated telphers, in case a cab is attached to carry an operator.)

By studying these terms, it will be easy to see that various types of hoists are really separate pieces of equipment, and as such, may be used individually, just simply for hoisting the load, or they can be attached to trolleys or telphers and operated on monorails. When used in this manner, they become an integral part of the transporting equipment.

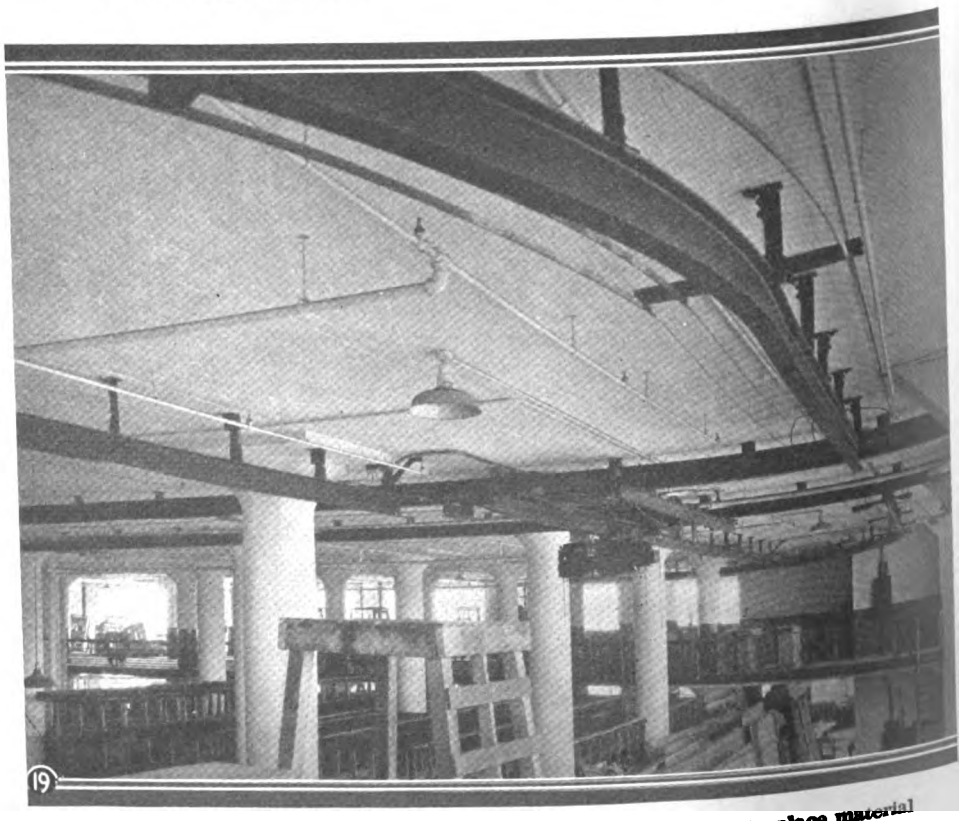


Fig. 19. Transfer cranes in each bay make it possible to place material on any part of the floor.

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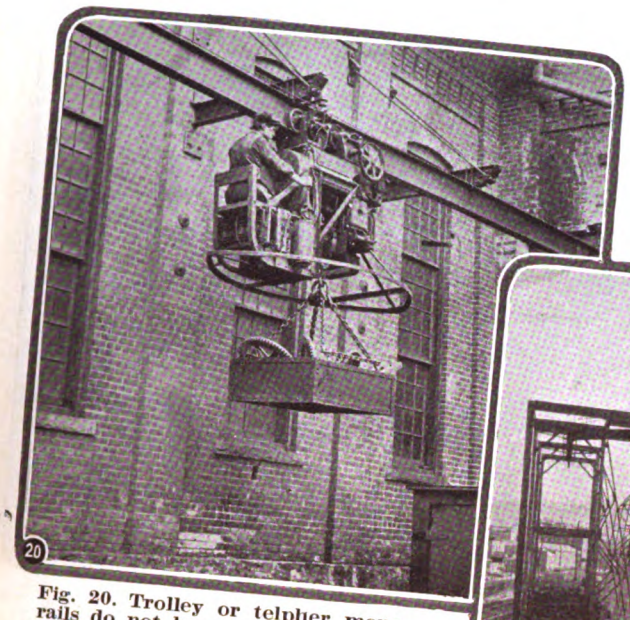


Fig. 20. Trolley or telpher monorails do not have to be supported by expensive super-structures, but can be hung from the side of the buildings or on existing structures.



Fig. 22. General view of coal storage yard of the American Car & Foundry Company, showing additional spur for unloading car on siding.

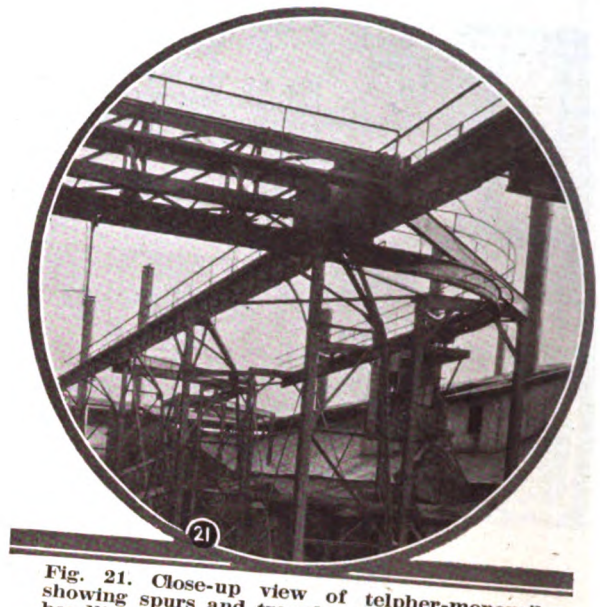


Fig. 21. Close-up view of telpher-monorail showing spurs and transfer crane in the coal handling system of the American Car & Foundry Co.

The monorail itself is nothing more than a carrying medium for the other equipment.

The monorail or telpher system has been termed the aerial railway of industry, and any study of this system of transportation must take into consideration the fact that the monorail system is a *rail* way system, and is subject to the advantages and disadvantages of being held to a fixed line of travel.

The simplest form of monorail equipment consists essentially of a hoist, suspended from a trolley, which may be moved along a rail. Other types consist of an electric hoist, mounted on a trolley which is electrically operated,

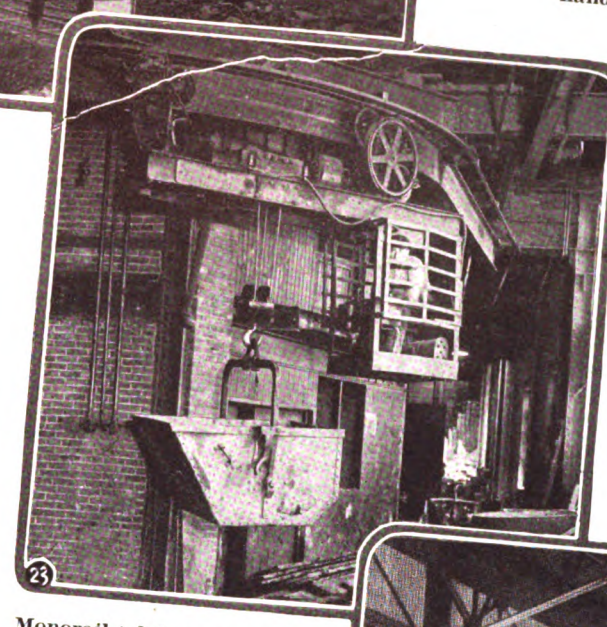


Fig. 23. Monorail telphers operate in the most congested places. This shows clearly a two-way switch and the method of supporting the electric current conductors.

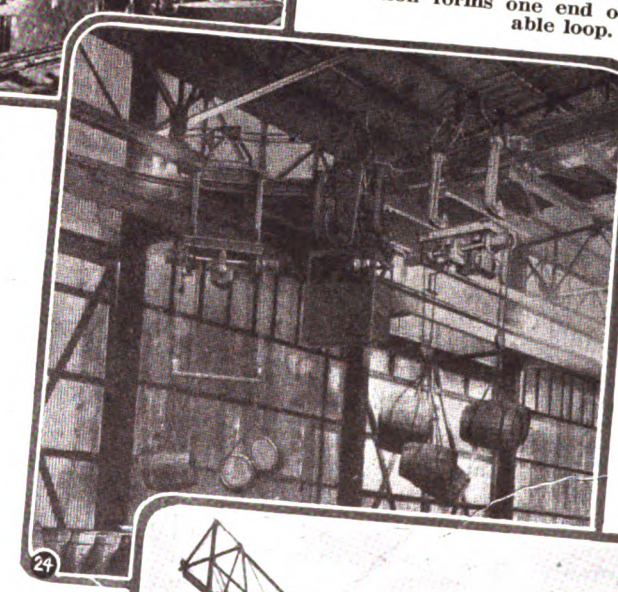


Fig. 24. View in a marine terminal shed showing telpher-monorail, where the telpher acts as a tractor and pulls two trailer hoisting units. The transfer crane in this installation forms one end of an adjustable loop.



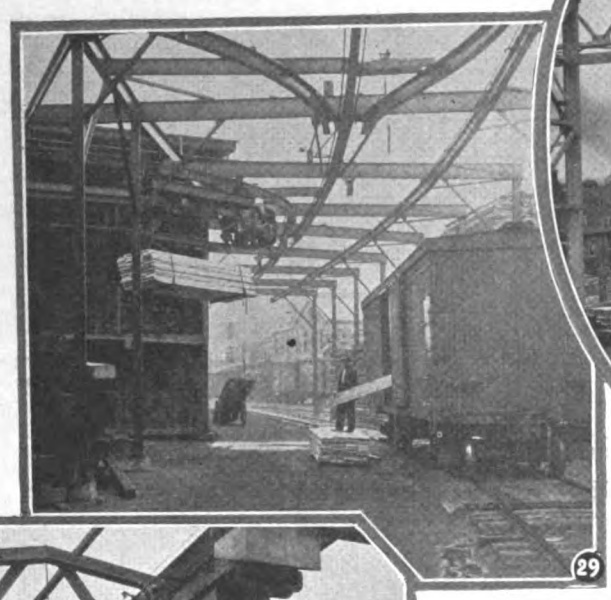
Fig. 26. Where machinery is placed close together, the telpher monorail system is indispensable. This shows the method of handling paper from storage platform to cutting machines at the plant of Dill & Collins Co., Philadelphia.



Fig. 25. Yard space is valuable for bulk storage and light super-structures give the telpher-monorail many advantages over the large cranes for conveying material as shown.

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Fig. 27. The hoist hook on the telpher monorail system can be equipped with grab bucket, sling, or magnet, depending upon the material to be handled.





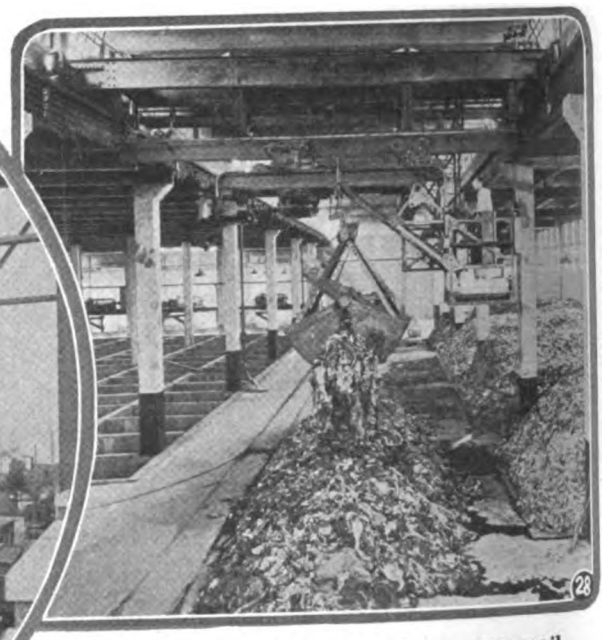


Fig. 28. This telpher monorail equipped with grab bucket has effected a saving of 50% in costs for the handling of calfskin trimmings at the plant of the U. S. Glue Co., Carrollville, Wisconsin.



Fig. 29. Direct from car to storage pile without rehandling is the secret of the savings effected by the installation of this telpher monorail system in the plant of a large lumber company.

Fig. 30. A close view of the load grapples and super-structure for supporting the monorail. This shows one method of feeding to storage piles.

and is known as a telpher. These simple forms of equipment can be elaborated by the addition of a cab for the operator, or the trolley can be used as a trailer behind the telpher.

The electrically operated telpher from which is suspended an electric hoist, is now gaining prominence. This form of equipment is midway between the hand chain hoist and a travelling crane. The movements of the hoists are controlled by means of ropes from the floor and the operator walks along with the hoist, figure 14. This equipment is used where the machines do considerable travelling, and the distance travelled per trip is comparatively short, and there are no obstructions to prevent the operator from walking along the floor or ground. They are used in structural shops on the assembly floors to feed small parts to machines which lie slightly out of the line of travel of the crane, and in foundries, and also to carry coal to boiler rooms where the amount handled is not large. They may be adapted for remote control but some manufacturers do no recommend this, due to the possibility of accident.

The telpher-monorail consists of a hoist and trolley which is fitted with a cab and the operator accompanies the machine at all times. This equipment is subject to many modifications. For instance, it may be only the simple electric trolley and hoist to which is attached a trailer supporting the cab and control mechanism, figure 26; or it might be a large machine with an extra heavy frame, upon which are supported both the cab and

(Continued on page 49)

Fig. 31. While transfer cranes are somewhat more expensive, they permit the telpher-monorail a greater access to all parts of the yard. This equipment handles 270,000 board of lumber per eight-hour shift with one operator and one chaser.

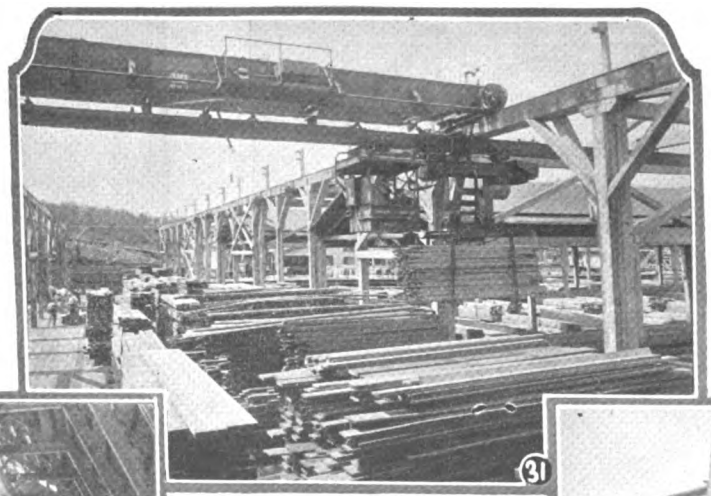


Fig. 32. The handling of fertilizer in bulk storage has always presented a problem. The telpher monorail in this instance accomplishes the work quickly and economically.

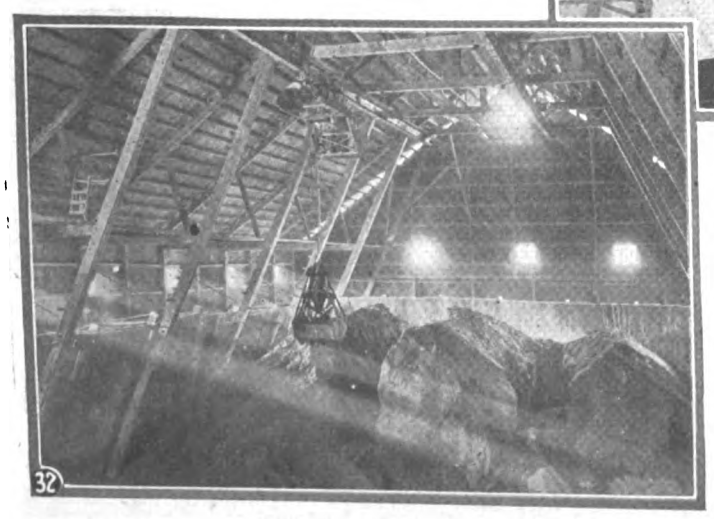
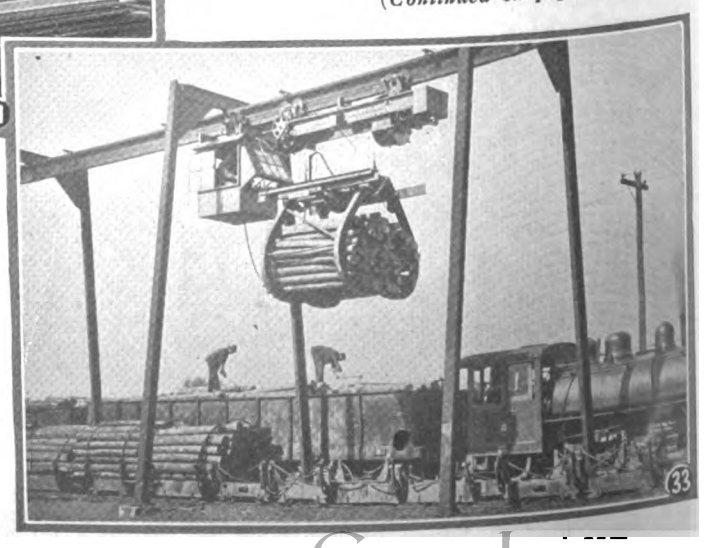
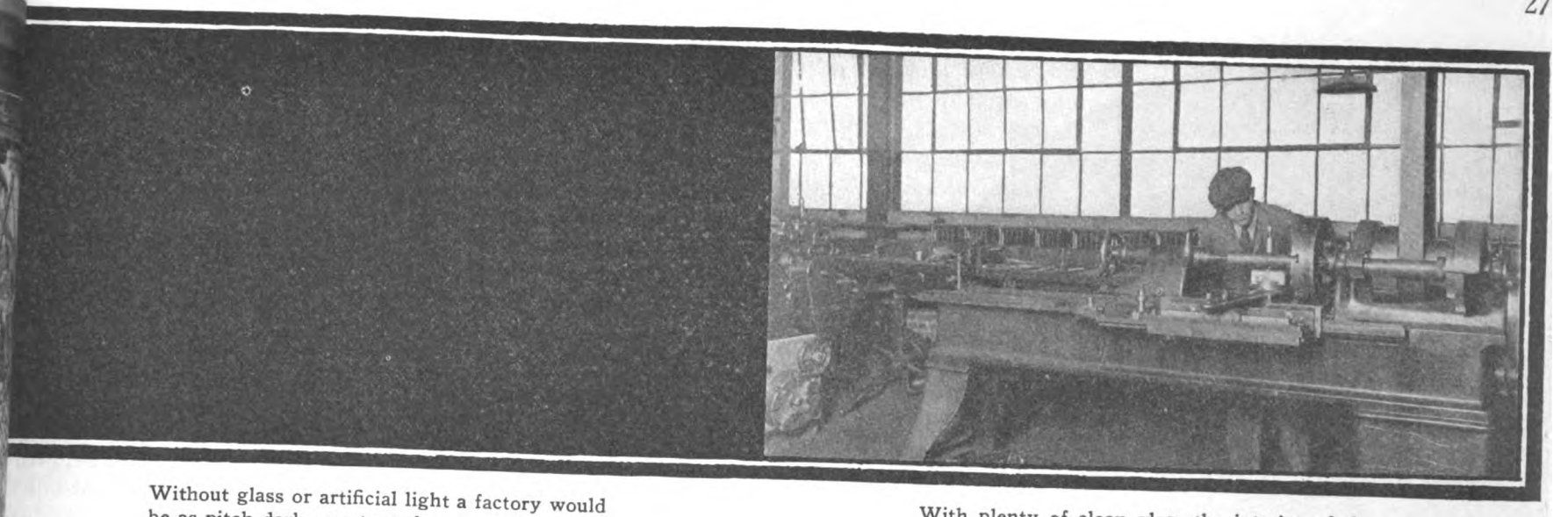


Fig. 33. The Michigan Wood Preserving Co., by installing a telpher-monorail system as shown, saved five men's wages on the tie handling operation. The grapple picks up unit piles of ties, transporting and placing same on special cars for creosoting, and is also used in the loading and unloading of cars.



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Without glass or artificial light a factory would be as pitch dark as a tunnel.

With plenty of clean glass the interior of the factory is flooded with perfect light.

Why Don't You Use Tin Where You Now Use Glass?

A RIDICULOUS question? Not at all. Of course, tin will not let in daylight. Neither will dirt, rust, and soot encrusted glass

You realize that to increase production, decrease spoilage and minimize accidents, proper illumination is vital.

But, are you enjoying the benefits of proper illumination? Does the only perfect light—Daylight—flood the interior of your plant?

Or does dirty glass bar out the daylight—keep your plant dark and gloomy—make necessary expensive light bills for artificial illumination?

The short, dark days of winter will soon be here. But like hundreds of other great manufacturing institutions, foundries, steel mills, etc., you can have a well daylighted, cheerful plant this winter. For it is easy—economical—highly profitable to clean the dirtiest ribbed glass with—

Skybryte CLEANER (LIQUID)

Skybryte liquid cleaner for ribbed glass dissolves and cuts the most stubborn crust of grease, rust, carbon scale, soot and dirt—practically instantly. Yet it is absolutely harmless to putty, paint and window sash.

Easy to use. An unskilled laborer dips a brush in Skybryte and coats the dirty glass. At once the hardened crust that was impregnable to other means of cleaning loosens. Then, flush off with water. The glass is clean. Daylight floods the interior of your plant.

Skybryte is inexpensive. Five gallons cleans 4,000 square feet of dirty ribbed glass. An unskilled laborer cleans 5,000 square feet per day. The average total cost of cleansing is less than ¾c. per square foot, including both labor and material.

Write for Trial Offer

Skybryte is guaranteed to win your prompt, enthusiastic approval. We are glad to prove it, entirely at our risk. Write for particulars of our trial offer. Also, concerns in your city using Skybryte. Please state approximate square footage of glass to clean.

To Better Serve America's Industries

The Skybryte Company after considerable research and experimental work has perfected these other products.

SKYBRYTE Cleaner (Powder)

For plain or polished glass. No water necessary. No dust. No muss. No scratching.

SKYCO NO-GLARE

A window coating that lets in all the light but eliminates the heat and glare.

SKYCO SASH PAINT

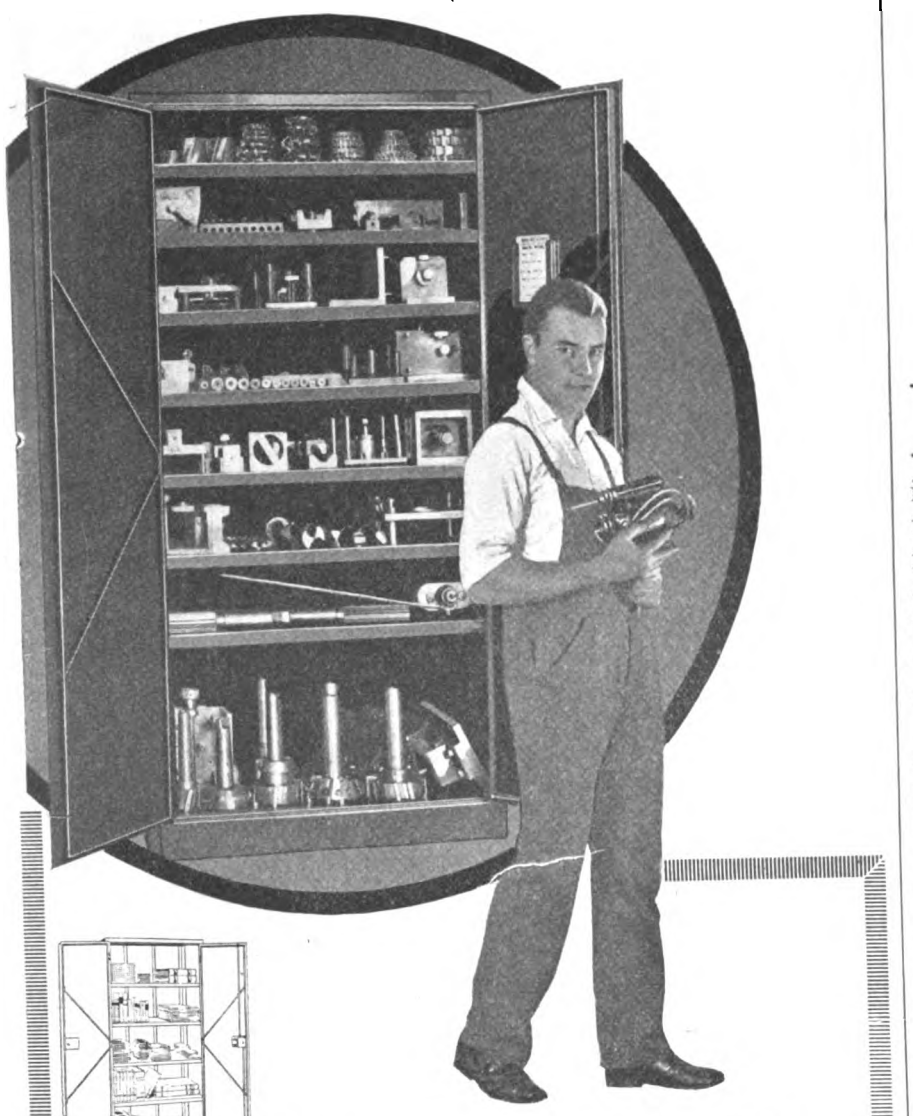
Costs more per gallon but less per job.

THE SKYBRYTE CO.
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Thirty minutes with America's foremost light expert. An intensely interesting book brim full of valuable facts on proper illumination. Gladly sent on request.

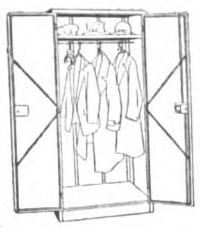
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For books, records, advertising material, forms, supplies, this is the ideal storage cabinet. Keeps out dirt, dampness, vermin, rats and fire.

Storage for Anything

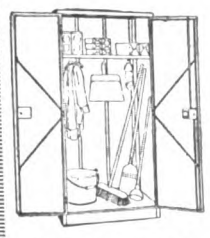


Inserting coat rod turns it into a handsome wardrobe accommodating six persons easily. Adds to the looks of any office.

Everything costs so like the dickens—tools, dies, jigs, patterns, parts, etc., not to mention factory forms, stationery and miscellaneous supplies. And the waste, loss and spoilage of these expensive items runs into many dollars a year.

How do *you* protect such materials from dust, dampness, fire, petty pilfering and carelessness? The Van Dorn All-Purpose Steel Storage Cabinet is mighty cheap insurance against such losses.

It is roomy—36 x 70¾ x 22½ inches inside. It is sturdy and well-made. Shelves are quickly adjustable. The door closes tight, and locks safely, top, middle and bottom. It is low enough in cost for the plant, and handsome enough for the front office.



By taking out some of the shelves, it makes a practical janitor's closet. Why not keep even these supplies in a neat and orderly manner—and safe!

While you think of it, see it at the Van Dorn dealer's or send for catalog—*and stop those leaks.*

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MASTER-CRAFTSMANSHIP IN STEEL

The Advertising Department and the House Organ

By Maxwell Droke

FOUR years ago I made a survey of internal or employee house organs in the United States. At the time I commented upon the fact that more than two-thirds of these publications that came under my observation were edited by the manufacturer's advertising department.

I have long been opposed to any policy which contemplates placing the responsibility of an internal house organ upon the shoulders of the advertising manager. It's not that I'm so solicitous about the welfare of the poor, overworked advertising manager, although goodness knows he usually has enough to keep his hands full without seeking new worlds to conquer.

No, I'm thinking of the worker's side of it. And I have taken my stand as a result of several years of first-hand experience and observation in the industrial field. As an advertising executive, I have edited a pretty fair factory magazine, as such publications go. Having a natural inclination for the work and some experience in the field, I devoted, perhaps, more time, effort and thought to the magazine than the average advertising man would expend on a similar publication.

And yet, looking back now, I can see that I was a failure—or, at best, only a near success. The workers read my magazine. They liked it. I rather think, too, that they liked me. And yet, somehow, I was never quite able to sell these folks *The Spirit of the House* exactly the way I wanted to. For one thing, I did not have the time. There simply were not enough hours in the day to enable me to do my regular work, to say nothing of this "side-line" as my superiors termed it. Another thing is that my position forced me to live in one world, while, in my editorial duties, I was endeavoring to make contact with a totally different world. It seldom works out well. Despite my efforts to "mix in" with the workers, the fact remained that I was a "front-office" man. I had a little cubby-hole, with my name on the door, and a gum-gargling gazelle to "take" my letters. That let me out. Much as I might yearn to do so, I could never quite get the complete confidence of the time-clock punchers. I just wasn't in the right position to do it, that's all.

Nor was my position an unusual one. Many similar instances come to mind. I recall especially the case of an advertising manager of a large musical instrumnt house. The vice-president came to him one day a year or so ago with flattering words and a rough dummy of a proposed factory house organ. "Here, Jimmie," he said, "you take this thing and whip it into shape. You're the very chap to do it. You can sell anything with paper and ink—and we've certainly got a big idea to sell the workers. Gotta do away with all this friction in the factory and speed up production."

Well, "Jimmie" went to the mat with his superior officer. "I can't see your point at all," he declared frankly. "Just because I have demonstrated my ability to sell musical instruments to intelligent, upper-class Americans, I see no reason why it logically follows that I should be able to 'sell' an institution to its begrimed, illiterate laborers. I am perfectly frank to admit that I don't understand these people. I have no contact and no common interest with them. I can 'get you up a magazine' as you put it. That's simple enough. But I can't get you up *the* magazine you need. I'm not a snob, but I have sufficient common sense to convince me that this isn't my job. I'd never 'convert' those workers if you gave me a million years and ten days extra to do the job."

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And thus the battle raged r half a day. But in the end e advertising manager won s point, and the company ployed a special editor to vote his entire time to the ctory publication.

Where two or more manu- cturers are gathered to- ther in the faith, the chances e better than even that soon- or later the talk will drift the Human Factor. The bor problem is the one prob- m that is never quite settled any factory. Industrial un- st in greater or less degree, as come down to us through ie ages since the first labor rike at the Tower of Babel. Just now we are particularly oncerned about labor turn- ver, and kindred problems. here is much talk of discon- nt, revolt and bolshevism in he ranks of labor. No clear- hinking American executive takes stock" in the conten- ion that this bolshevism will nanifest itself in wholesale nurder, sabotage and ruth- essness.

And yet we know full well hat there *is* a bolshevism in America today. Not so radi- al, not so insidious, mayhap, as the "made-in-Russia" brand. But nevertheless it of- fers a deadly danger to indus- try. It is the bolshevism of "hands-without-the-heart" la- bor; the bolshevism of the man- turned machine; the automatic worker who has no abiding, deep-seated faith in the hand that signs his pay check, and who distrusts all things capi- talistic.

That is the bolshevism we need fear in America. It is the bolshevism against which our industrial leaders wage un- ceasing battle. Its poisonous fangs can dig deep into the very heart of an organization, contaminating its life blood, and turning a living, breathing business into a ghastly, flesh- less skeleton.

And there is only one way to eliminate it. This brand of bolshevism must be beaten down by a campaign of Under- standing. This is the real mis- sion—the outstanding task—of the internal house organ. Here is a job to which the best efforts of a powerful publica- tion may well be consecrated. But if the factory magazine is to measure up to its responsi- bility *it must be properly edited!* It isn't a part-time job for the advertising manager, or a task to be blithely passed along to the president's nephew who "has a knack" for writing. No, sir! The factory magazine is too potentially im- portant a publication to be carelessly disposed of in any such manner.

A number of years ago I pre- dicted the coming of a new man in the realm of industry. A real internal house organ edi- tor. I said that he would have to be a big man. A creator of the Family Spirit. A sort of industrial wizard, creating mir- acles with human chemicals—a man who could weld Capital, Labor and Management into a single unit, and make them see that they are all members of this lodge, in good standing.

Above all, our internal house organ editor should have the Understanding Spirit. He must be the literal heritor of those who saw the Angel bar the Garden Gate and heard his command "By the sweat of thy brow." A worker. A worker who has lived, and suf- fered, and learned the lessons





World-known leaders in every branch of manufacturing are found on the list of Arex Installations:

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Packard Motor Company
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VENTILATION performs its *greatest* service in the industries.

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Arex engineers for more than fifteen years have been correcting profit destroying conditions of every nature. Steam, smoke, heat, fumes, foul air, gas—any menace that may exist in your building has been successfully handled by these experts many times before.

Their corrective system of siphonage ventilation which requires no power equipment is practical for a single room or an entire factory. The low first cost and expense of installation will surprise you—in many cases the savings effected balance them within a few months.

Put your problem before these engineers for consideration. The specification blank below will bring you a complete survey without cost or obligation. Attach rough sketch or blue print of building and address Arex Company, Engineering Division, 1583 Conway Building, Chicago.

AREX COMPANY
J.C.Kernchen, Pres.
INDUSTRIAL VENTILATING ENGINEERS

GET THIS 20-PAGE BOOKLET ON SIPHONIC VENTILATION

It contains a discussion of types of ventilators,—their applications for different kinds of work and buildings,—blue-print sketches for various roof structures,—exhaust capacities and dimensions of Arex Ventilators.



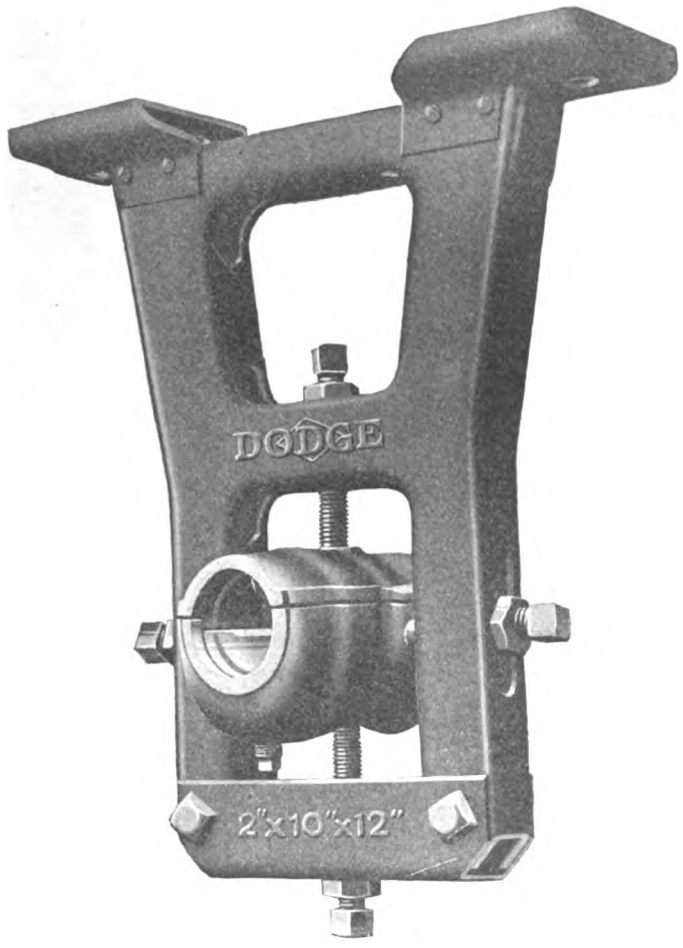
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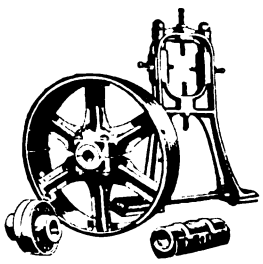
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"THERE is a practical hanger" is the opinion of experienced millwrights who examine this popular addition to the Dodge line of power transmission equipment.

It is light—strong—safe—easy to erect—unbreakable and low priced. Two years of careful experiment is embodied in its design and construction—it has withstood tests far more severe than any that will ever be encountered in regular line shaft service.

Dodge steel hangers are guaranteed by Dodge Quality which has been recognized for over forty years as an assurance of low first cost, low upkeep expense and continuous trouble-free performance.



Buy Dodge steel hangers as well as pulleys, clutches, couplings, collars, etc., from your local dealer on the immediate delivery basis.

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DODGE MANUFACTURING CORPORATION

General Office: Mishawaka, Indiana; Works: Mishawaka, Ind., and Oneida, N. Y.

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of everyday existence. He must be a man who really *knows* how much $28.00 a week is, and how far it will go. And how long even an eight-hour day can be, if you have to sit stooped over a machine from morning till night. He must be a man who can see a host of tired, dirty workers flooding the open doors of the factory, as the evening whistle blows—and get a thrill out of the sight. Yes, that kind of a man.

I've done a deal of thinking about this new man—this modern Moses in industry. I have talked to industrial leaders about him. We have combined our visions and agreed upon certain well-defined fundamentals. As nearly as I can put it into words, the job that confronts the editor of a factory magazine today is to make the laborer see that his company is more—much more—than an embossed letterhead and a lithographed pay check. The workingman must be convinced that the company lives. And breathes. And thinks. *And is interested in the worker and the worker's welfare!*

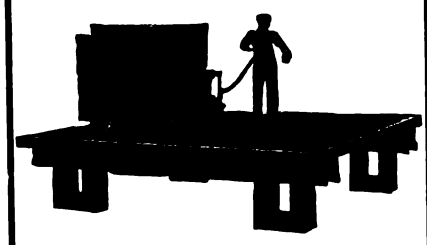
And now, I am beginning to see my Understanding Man step boldly forth and take his place in the ranks of industry. Rapidly he is becoming a reality. His number is limited. There are as yet far too few of these Understanding Men. But more—and still more—will come, as the need becomes apparent to a steadily increasing number of industrial executives.

This Understanding Man is to be a sort of super advertising manager—selling the company to the worker. But let us not forget this fundamental rule of advertising: The article to be exploited must stand the pitiless test of publicity. No matter how clever, and how earnest, the Understanding Man may be, he can do little permanent good for the manufacturer who does not wholeheartedly believe in and practice a square-deal, meet-the-worker-halfway policy.

Freight car loadings have reached new high levels. This extraordinary volume of railway traffic reflects not only the seasonal movement of crops, but the heavy production and purchasing of goods earlier in the year.—*The Guaranty Survey.*

Cost Less-Weigh Less and Live Longer

No weight except where weight is needed



From Drawing Board to "Nesting"

Lewis-Shepard Lift Truck Platforms are planned, designed and built with exacting eye for

MINIMUM WEIGHT

Moreover—the design of the Lewis-Shepard Lift Truck Platform insists on *all pressed steel,* scientifically folded and formed so as to *secure* this minimum weight and at the same time *insure* MAXIMUM strength.

Lewis-Shepard Lift Truck Platforms

(1) Weigh less
(2) Nest easier
(3) Fit any type of truck
(4) Live longer because they're stronger

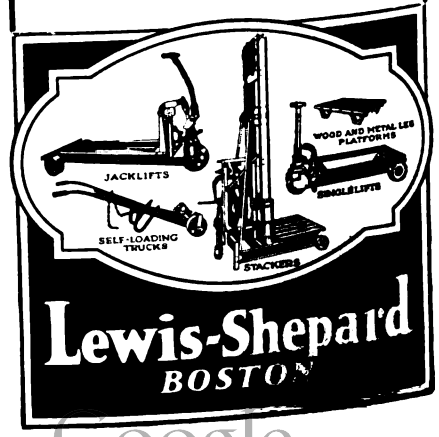
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Truck Deliveries
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Women's Wear
Woodworkers
X-Ray Equipment



THE leading firms in the industries listed above are using Calculagraphs to record *elapsed time.* The Calculagraph prints on the job ticket starting, stopping and *elapsed time.* If you would like to know more about the application of the Calculagraph to your own business write for our booklet "Elapsed Time Records."

THE CALCULAGRAPH

THE ELAPSED TIME RECORDER

34 Church Street, New York City

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Liability for Transportation Delays

By Leslie Childs

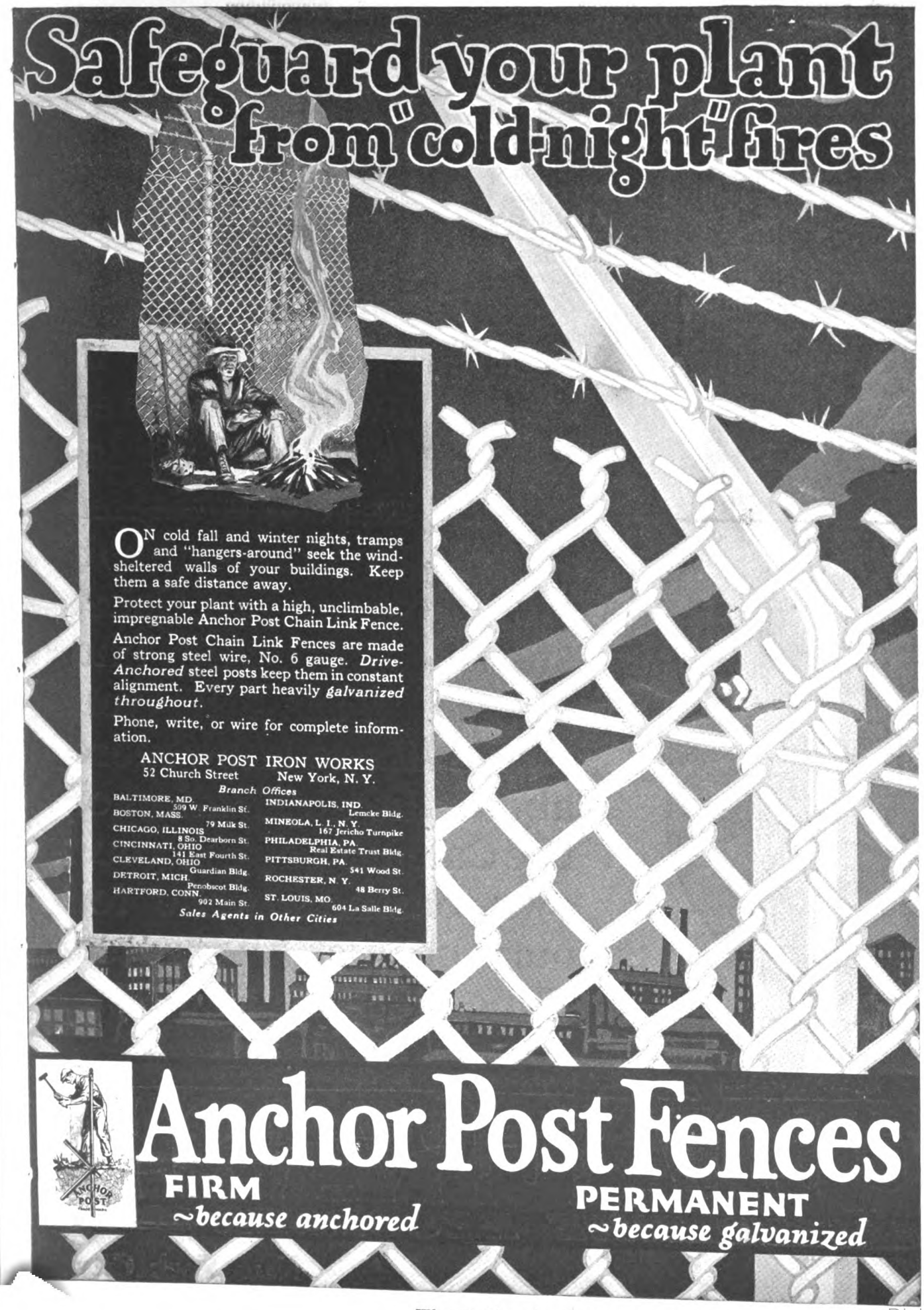
OCCASIONS frequently arise, in the operation of an industrial plant, where delay in the receipt of machinery or equipment may necessitate the shutting down of operations with its attendant loss. Especially are situations of this kind prone to develop where there has been a break-down in an essential piece of equipment, which prevents the further operation of the plant until repairs are made. If then this equipment is sent, perhaps to a distant point for repairs, the question of the liability of the carrier for special damages for failure to promptly transport same may easily arise.

This point of law has been the subject of considerable litigation, but, as each case of the kind has necessarily been decided in the light of the particular facts involved, it cannot be covered by the statement of a hard and fast rule. However, generally speaking, a carrier cannot be held liable for special damages, for delay in the shipment of machinery or equipment which causes the shutdown of a plant, unless such carrier is informed explicitly of the peculiar facts of the case, whereby delay will cause special damage to the shipper, not ordinarily within the contemplation of the parties to such a shipment. The application of this rule of law is illustrated in a striking manner, in the recent Kentucky case of Moss Jellico Coal Company vs. American Railway Express Company, 248 S. W. 508, under the following facts:

The Moss Jellico Coal Company was operating a coal mine, almost wholly by the use of electrical equipment, the power being furnished by its own power plant. Upon the occasion out of which this action grew, it discovered that an essential part of the machinery of its plant was in need of repairs the removal of which would necessitate the shutting down of the whole plant.

This piece of machinery, the nature of which does not appear in the report, was thereupon taken out and shipped by way of the American Railway Express Company to Knoxville, Tenn., for repairs. An agent of the coal company followed the shipment to Knoxville the following morning, found the bill of lading in the express company's office, but no trace of the machinery was ever found. It had, it appears, been lost in transit.

After a fruitless attempt to locate the piece of machinery, which consumed several days, the coal company ordered a



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Two Ways of Heating—



—and the better way costs no more

Heating by means of direct radiation is simply a process of warming dead, stuffy air—but heating by blowing heated fresh air into shops, factories and offices is heating and ventilating *combined*.

A Clarage heating and ventilating system is cheaper to install under ordinary conditions than a direct system which supplies heat alone—and often the operating cost is considerably lower. Moreover, an air washer and humidity control can be added, providing ideal air conditioning which invariably improves the health and efficiency of employees.

For a number of years, Clarage engineers have made an intensive study of ventilation. They know from experience the proper system and fan equipment for your plant. Ask them to either assist you directly or work with your engineer or architect.

The Clarage catalog No. 52 fully covers the subject of heating, ventilating and humidifying. Have you read it?



The famous Clarage Multiblade Fan Wheel. The blades are formed with dies, insuring absolute uniformity. The spider, in all larger sizes, consists of steel arms accurately cast into iron hubs. The Clarage Ring Oil Bearing.



The Clarage Ring Oil Bearing

It is adjustable in all planes, insuring correct alignment, and it is provided with felt washers to keep the oil in, and dust out—an exclusive feature.



Where Ventilation Pays

Clarage fans are made for ventilating kitchens, exhausting fumes, gases, dust, for ventilating toilets, for supplying properly conditioned air necessary in manufacturing tobacco products and textiles. They are also widely used for pneumatic conveying, supplying draft to furnaces, cupolas, forges and countless similar uses. These applications are covered in a book, "Moving Air." Write for it.

Branches: In Principal Cities
Complete Stocks Carried at New York and Pittsburgh
Special Stocks at Memphis

CLARAGE
FAN COMPANY
FANS~BLOWERS~EXHAUSTERS
KALAMAZOO, MICH.

Clarage Fans are built in types and sizes for every service.

new piece of machinery in its place which was in due time installed. This delay, however, compelled the coal company to cease all operations for a period of 18 days, and to recover damages for the value of the machinery as well as for the loss of profits entailed by this shutdown, the instant action was instituted.

Upon the trial of the cause, the trial court directed a verdict in favor of the coal company for the value of the machinery, but declined to hold the express company liable for special damages alleged to have been caused by the forced shutting down of the coal company's plant for 18 days. From this judgment the coal company prosecuted an appeal to the higher court where the question of the correctness of the trial court's ruling, on the right of the coal company to special damages, was squarely in issue.

As the deciding of this question turned upon the construction to be given, the instructions notice and information the coal company had given the express company, at the time the machinery was delivered for shipment, the court directed its attention to this phase of the case, and in summing up the evidence on this point it was, among other things, said:

"The evidence of plaintiff's agent, Wallace, who delivered the piece of machinery at the station, is that he had no particular talk with the express agent at the time as to what was to be done with the machinery, but he did tell him he wanted it sent that evening, so it would get to Knoxville, and that witness was going to follow it the next morning and have it repaired; that he did not remember of having any discussion with the express agent as to whether the mine could operate without this machinery, but he told him he wanted it sent to Knoxville to be fixed, so that they might operate the mine on Monday. The express agent stated, in substance, that Wallace told him the mine could not run until the machinery was fixed and returned, and the statements of these two witnesses constitute the whole evidence of knowledge or notice upon the part of the express company or its agent . . ."

Following the above sum-

If we would save you 50% on the cost of the soap

used in your employees' wash rooms and would prove it to you, and at no expense to you whatsoever, it would interest you, wouldn't it?



Hang up your soap with a soap-holder

and you'll hang up a new record for low soap consumption.

To any user of our soap we will supply the fixtures free of charge as long as you use our soap, and we keep them in condition.

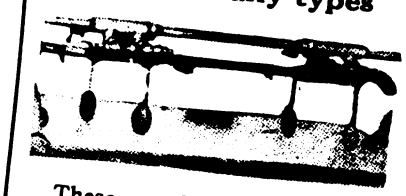
Free trial offer

We will send you fixtures to equip your washroom together with a sufficient amount of soap to give it a thorough tryout and remember it costs you nothing. Neither does it place you under any obligation to us whatsoever.

Cut washroom maintenance costs

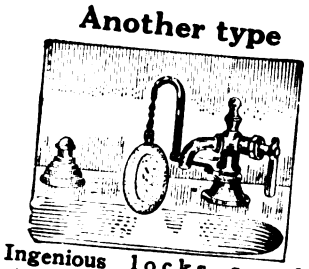
With the soap-holder—Soap cannot be carried away, thrown on floor, or left in water to become soft, mushy and unfit for use—it cannot break up when worn and clog drain or make the washstand untidy.

One of many types



These soap-holders are made in many different types and designs. They are made of brass, heavily nickel-plated, or of German silver and extra strong to resist tough usage.

Another type



Ingenious locks securely attach the soap to fixtures by means of an anchor imbedded in the bar of soap.
Where these fixtures are installed—every ounce of soap is used.

Write today for full details.

ANCHOR CORE ECONOMY SOAP CO.
136 West Lake Street, Chicago, Ill.

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ming up of the evidence, as to notice given the express company at the time of delivery of the machinery, the court turned to the question of whether or not this notice would justify the imposition of special damages upon the express company for the shutting down of the coal company's plant caused by the loss of the machinery. In reaching its conclusion upon this point the court, among other things, said:

"In this case the only notice given to the defendant was that the plant could not operate without this piece of machinery; but that does not necessarily imply that the plant would be operated, if that piece of machinery was not out of repair, or that its operation would not be stopped for some other reason. Nor does it imply that, even though it necessitated stopping the operation, loss of profits, or loss of any kind, would result therefrom. There is nothing in the evidence from which it may be inferred, either that knowledge was had or notice given that the plant was operating at a profit, or that it would operate, except for the condition of this piece of machinery * * *.

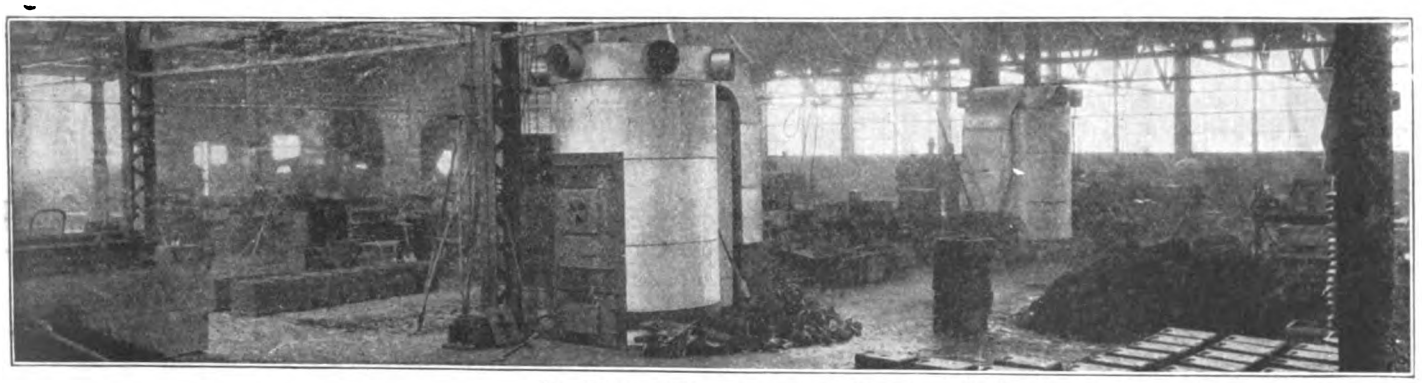
"To make such a notice of the special circumstances sufficient to authorize a recovery for special damages, there must be imparted to the carrier information of such facts as will bring home to it the peculiar facts and conditions known to the shipper that will entail upon him a loss not ordinarily within the contemplation of the parties, if the shipment is lost or its delivery delayed * * *.

"Justice and fair dealing require that, when you expect to recover from a carrier damages of this nature, which are not apparent upon the face of the transaction, such notice be given as will put the carrier on guard, and give it some idea of the additional responsiblity involved * * *.

"The knowledge of the agent as alleged being the same as the notice proven to have been given to him, and that notice not being sufficiently explicit as to the facts and circumstances to authorize the assessment of special damages, we think the action of the lower court was proper * * *."

In conclusion the higher court affirmed the judgment of the trial court, allowing the coal company damages for the cost of the piece of machinery lost, but denying it special damages for the alleged loss of profits because of the shutting down of the plant for eighteen days awaiting the installation of a new piece of necessary machinery.

It is obvious that the foregoing Kentucky decision is one of importance and value to industrial executives in general. It illustrates in a striking manner the importance of a clear explicit notice to the carrier of the facts and circumstances which will result in special damage to the shipper if a given shipment is lost or delayed, if the shipper intends to hold the carrier liable for such special damage. Truly then this Kentucky decision is one of value on the point decided, and its holding may with profit be had in mind by every industrial executive, when delivering shipments to carriers of such importance that their loss or delay will result in special damages to his firm.



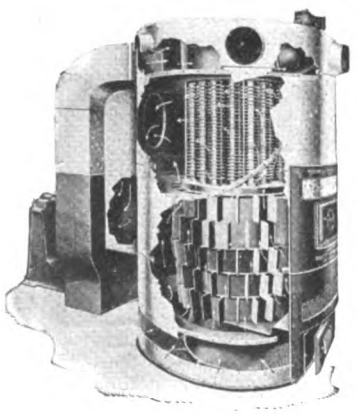
Two Sturtevant Heaters installed in Foundry of Peerless Co., Cincinnati, Ohio. The building is 120 x 200 ft., with an average roof height of 18 ft. Total exposed area of 7300 sq. ft. and a total glass area of 9700 sq. ft. The distance from Heaters to the most remote corner is 135 ft.

A COMPLETE HEATING AND VENTILATING UNIT

FOR FOUNDRIES, MACHINE SHOPS, AND ALL ONE-STORY INDUSTRIAL BUILDINGS

This great heater employs simple but radically different principles from other heaters. It forces warm air horizontally near the floor level in the direction needed. It puts warmth into every nook and corner.

Mechanical Hot-Blast Heater. Formerly manufactured by the Robert Gordon Co. Now built and sold exclusively by the B. F. Sturtevant Co., through their National Sales and Engineering Organization



1. Costs less to install than indirect heating systems and uses up to 50% less fuel.
2. Direct-fired. Burns economically either hard or soft coal, coke, oil, or gas.
3. Keeps the heat in circulation near the floor instead of allowing it to waste upward.
4. Ventilates. A Sturtevant Multivane Fan eliminates irritating fumes and steam. This is especially important in foundries.
5. Simple construction. Ordinary mechanic and helper can assemble it in a few hours.
6. Can be operated by anyone who can swing a shovel. Does not require the attention of a skilled engineer or boiler-man.
7. No steam or drip pipes to worry about. Nothing to freeze up.
8. Extended surface fins on the fire pot and the thin rings on the tubes provide a maximum heat-radiating surface.
9. Over-all efficiency is 81% by official test in the Laboratory of the Armour Institute of Technology. More than double that of any other type of heater.
10. Recommended for drying clay products, asbestos, magnesia, tobacco, cereals, vegetables, textiles, and all other products dried by warm air up to a temperature of 400°.

Shipment of these heaters can be made from stock if you act promptly. Call in one of our engineers and let him help you with your heating problems before the cold weather comes.

Send for Bulletin No. A306

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Experience

By C. A. Turner

ONE is greeted on all sides today with pleas for high grade help, in fact, help of any kind may suffice. It may be possible that a certain aid may result if the present available timber is carefully worked over in the light of its real quality. Such quality may have two essential indicators from the production point of view, and many others from the sales or commercial point of view. These indicators may be considered to be, basically, education and experience. Of education the writer dares not to discourse publicly. Of experience his feelings are different, and therefore, this opportunity and medium is being taken advantage of.

In making statements of facts, as observed, maybe things are said blandly, but it is for the sole purpose of stimulating others to talk or write on this subject that this article is prepared.

There has been passed down through the years the saying, "Experience is the best teacher." This may be a paraphrased version of a more classical allusion, which has been much used, and probably much abused. But at the outset, is it not probable that "experiment" may have been the original initial word in this epigram? It is hoped that its real significance has been appreciated more often than otherwise. Nothing but harm can accrue from any superficial treatment or consideration of such an expression—"Experiment is the best teacher."

Briefly, the word "experience" is defined: "Knowledge derived from one's own action." This is satisfactory as a beginning. Is it really all that it purports to be? Every one will concede that he has had years of experience, but if this short, terse definition holds, we may justly wonder whether he really has. Could "Experiment" have been better used?

The technically trained university graduate upon the completion of his academic activities turns towards work. To encounter work he must run the gauntlet of some few interviews which may be something like the following:

Executive Employment Manager (in a low but audible tone, while holding application blank for a position): "You are a graduate of State College in Engineering?"

Graduate: "Yes, sir."

Executive: "What has been your practical experience?"

Graduate: "Have done many things" (here prospect recounts various lines of effort, ranging from dish-washing to managing a small business, and amplifying each in turn).

(*Continued on page 39*)



Partial View of the Service Stock Room of the Delco Light Company, Dayton, Ohio. Here 46 Tons of Lyon Standard Steel Shelving Are Used to Store Delco Light Products. In Addition 2,000 Lyon Standard Steel Lockers Have Been Installed in This Factory.

The Adaptability of Lyon Standard Steel Shelving

In the October issue of Industry Illustrated was shown an installation of Lyon Standard Steel Shelving for storing heavy castings.

Here is shown the same type of shelving used to store light articles that girls can easily carry.

In large factories throughout the country you will find Lyon Standard Steel Shelving used exclusively for simplifying the storing of many varieties of products.

This evidences the adaptability of Lyon Standard Steel Shelving to meet the stores requirements of any manufacturer—no matter how simple or complicated the stores system may be.

And it also evidences the high quality of Lyon Standard Steel Shelving. For the preference of leading business institutions can be achieved only after experience over a number of years.

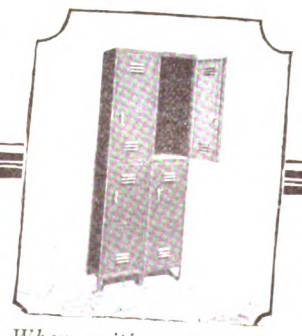
Perhaps our experience with the storage methods adopted by hundreds of large manufacturers may be of help to you. If so, it is offered gladly and at no cost to you. Simply write us direct or the division nearest you.

Lyon Metallic Manufacturing Company

Aurora, Illinois

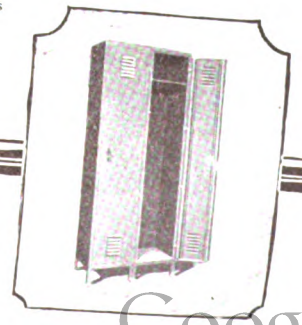
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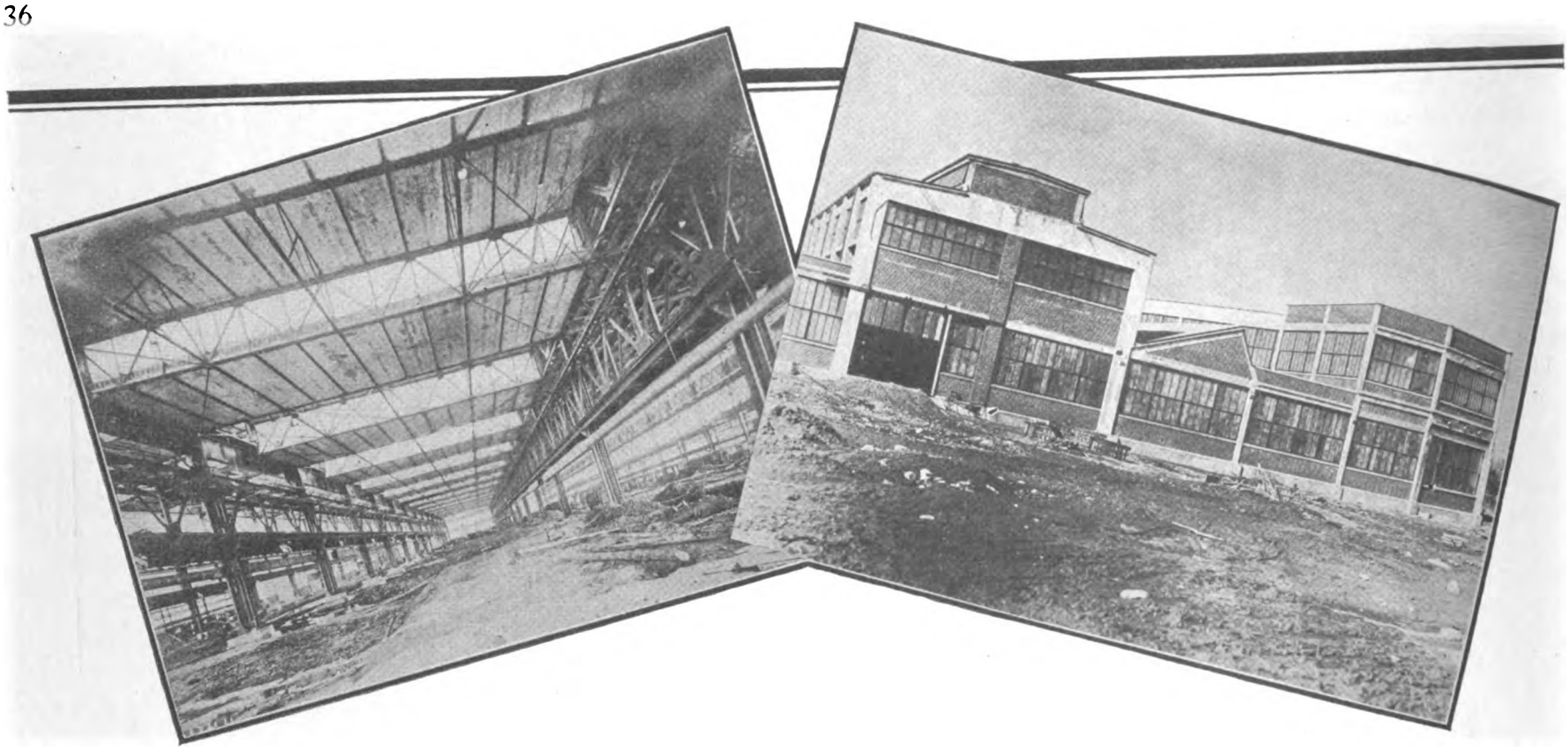
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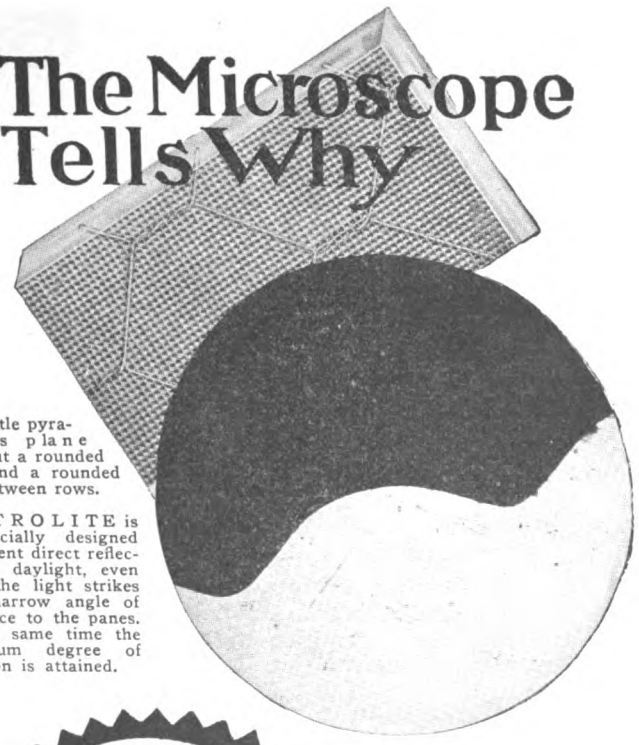
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Industry's Leaders are Believers in Daylight

The Microscope Tells Why



Each little pyramid has plane sides but a rounded apex, and a rounded fillet between rows.

FACTROLITE is scientifically designed to prevent direct reflection of daylight, even when the light strikes at a narrow angle of incidence to the panes. At the same time the maximum degree of diffusion is attained.

Here are a few of the many structures where better lighting prevails. Not by artificial light but by the use of daylight diffused through Mississippi Wire Glass.

"FACTROLITE" allows daylight to penetrate to all corners and permits employees to work facing the light. Glare is almost entirely eliminated and cost of plant maintenance is decreased to the minimum.

We recommend "FACTROLITE" for vertical openings, which gives perfect diffusion of the sun's rays, and "Pentecor" for skylights to give highest transmission and maximum illumination.

"FACTROLITE" eases eye strain on the workers nearest the glass and gives those in the building interior a clear shadowless light—ideal to work in.

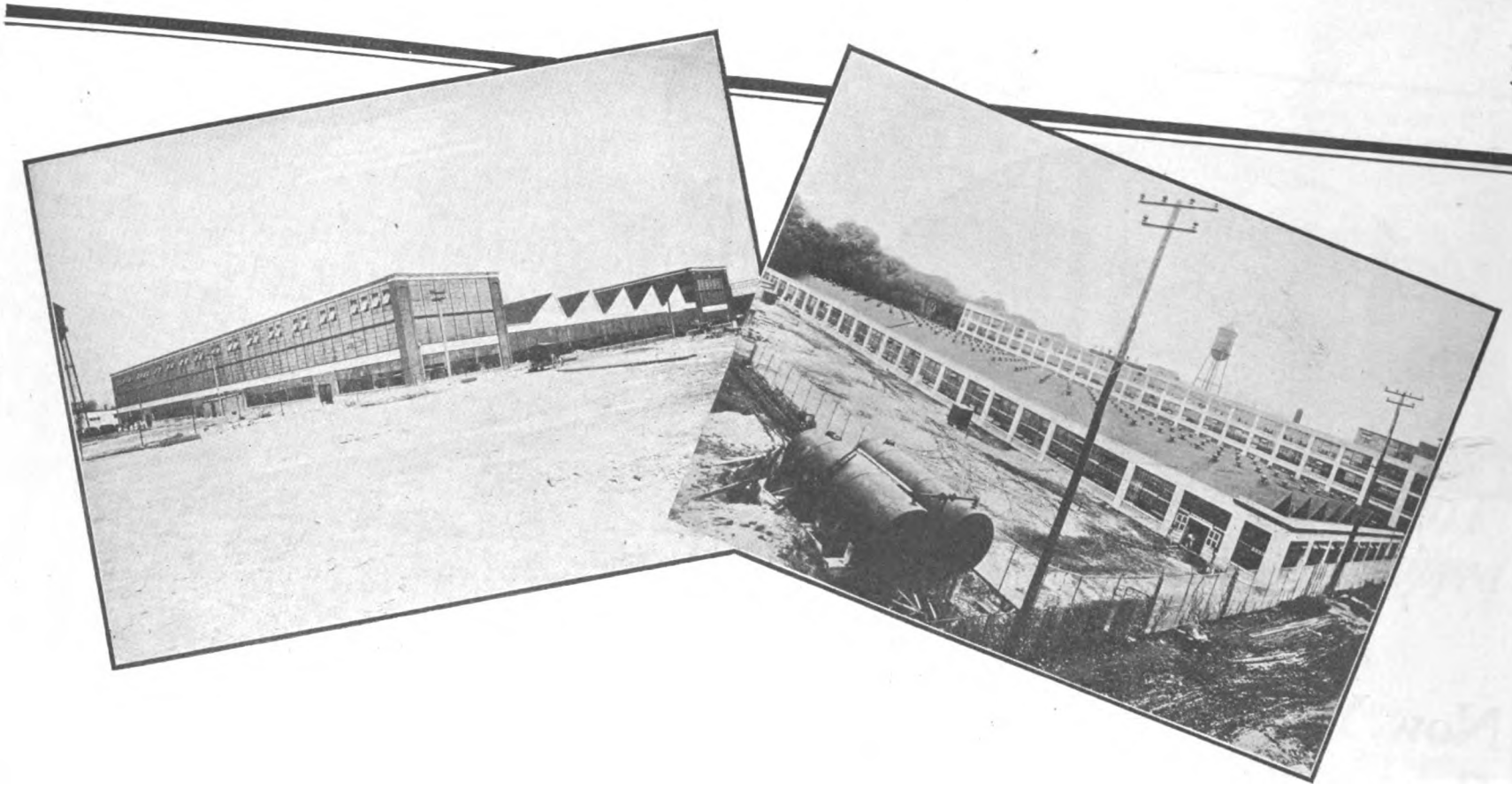
MISSISSIPPI - WIRE - GLASS - CO. WG FIRE RETARDANT No 32

Mississippi Wire

219 Fifth Ave.,

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for Increased Production with FACTROLITE

Note the clear light in the illustration showing an interior view. It is the utilization of daylight to the most efficient degree.

Mississippi Wire Glass in addition to aiding better production, minimizes fire risk and is the material upon which the underwriter's standard is based.

There are many types and designs to meet every industrial requirement for roofs, skylights, windows and other uses. Write for a sample.



This Coupon Brings a Sample of FACTROLITE and Full Data

Mississippi Wire Glass Co., 219 Fifth Ave., New York
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The Mogul Type REELITE is furnished equipped with the ever-wearing, rubber covered Rome Super Service Cord. The conductors are protected and insulated by the heavy rubber covering without any loss of flexibility.

Now You Can Carry All the Current You Need—*Anywhere*

The Mogul Type **Reelite** has opened new opportunities for labor saving by portable machinery. Material handling apparatus whose scope was limited because of the difficulty of current supply has been given a new broad range—has been made to pay larger dividends on the original investment at only a negligible expenditure. ***Reelite*** prevents the loss of time and expense of kinked and knotted portable cords. It keeps them clean and ready, from under the wheels of trucks and heels of workmen—keeps production steady with no loss of time for cord repairs. The heavy, protected cord is acid, weather and wear proof—safe under all conditions.

Daily, people are finding old operations for the Mogul Type **Reelite** to modernize and make more profitable. It is furnished with 1″ male threaded hubs, and is readily adaptable to any machine. Let the Appleton engineers help you apply it to your needs —you will be under no obligation or expense.

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MOGUL TYPE Reelite
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The Gun that brings down the cost of painting and cleaning

STOWE MULTIBLASTER outfits offer you a better, faster and more economical means of painting and sand blasting. This method consists simply of mixing paint or sand with compressed air and applying it to the surface by means of an especially designed nozzle. It has been used with noteworthy success in a wide diversity of industries.

The labor and time saved by the MULTIBLASTER may be gauged by the fact that one outfit will replace 6 hand workers on metal surfaces, and 18 to 30 men on wooden or concrete surfaces.

The MULTIBLASTER does a better job with less sand or paint. Positive and uniform distribution is assured by the fact that the paint is drawn into the spray by suction, keeping the ingredients stirred up. There is much less paint wasted as compared with the brush method.

MULTIBLASTERS require no tanks. Sand is syphoned from pit, barrel or pile—paint from any container.

There are several thousand MULTIBLASTERS in use, all sold subject to trial, and paid for.



"The Man Behind the Gu
(COPYRIGHTED)

	Price	Weight lbs.	Hose Suction	Pressure In. lbs.
Standard Size Sand Blast	$30.00	8	1	80-90
Medium Size Sand Blast	18.00	6	¾	60-70
Bench Blast	15.00	3	½	40-50
Paint Spray	12.00	2	½	40-50

Prove its value before you pay for it. Any outfit shipped for 10 days' trial, express or parcel post, ready for instant attachment to your air lines.

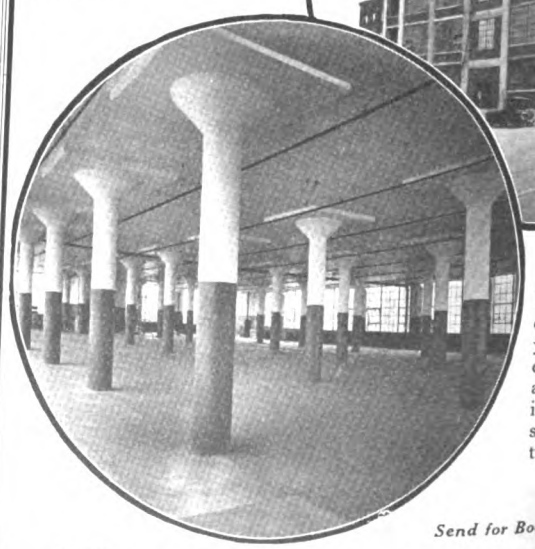
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Do You Need a Specialist?

When you are sick you just naturally look up the specialist for the complaint. Do you see the point? We are the specialists for your building troubles—troublesome jobs are the kinds we specialize in.

Anybody can build a simple job but when special or complicated, it takes a specialist



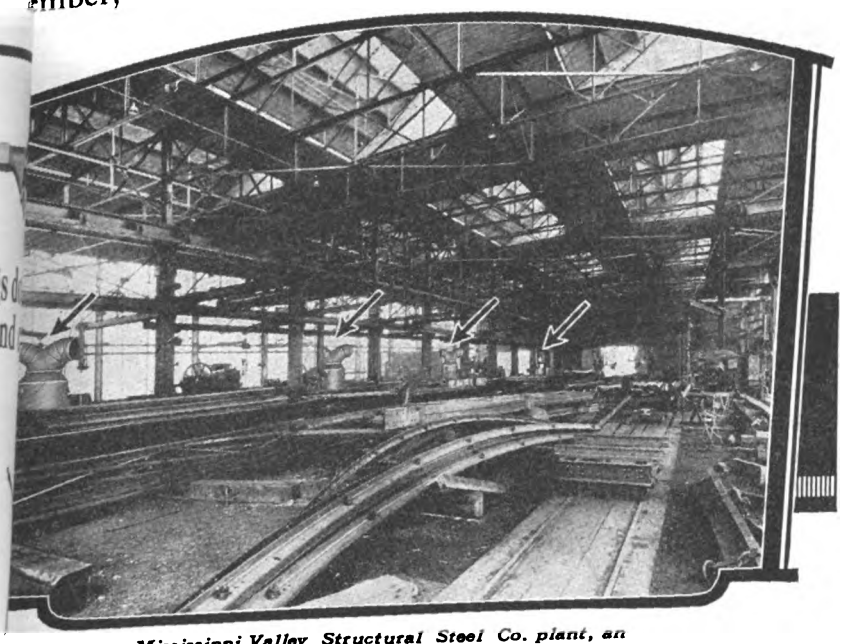


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FACTORY ENGINEERS AND BUILDERS
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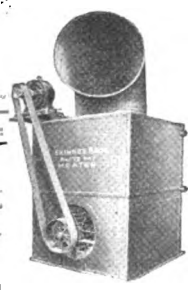
Mississippi Valley Structural Steel Co. plant, an extremely hard building to heat. Only 4 Skinner Bros. Type DF Heaters required.

narkable Performance of These Heaters Astonishes Engineers and Executives

JUST think of this! During the very coldest weather Skinner Bros. (Baetz Patent) Heaters will keep any steel-sash and glass building comfortably warm at all times—even if the heaters *are operated only three or four hours daily*. This type of building is notoriously hard to heat—probably the hardest of any—yet Skinner Bros. (Baetz Patent) Heaters are operating successfully in scores of buildings of this class, to say nothing of numerous others.

The remarkable performance of these heaters has been a source of amazement to engineers and executives—at first it seemed impossible that they could do what was claimed. But, after the most rigid investigation in hundreds of cases, these heaters were chosen above every other type.

Performance of Skinner Bros. (Baetz Patent) Heaters is guaranteed, when installed as directed by our Engineers. Find out more about them! They are revolutionary in design—pioneers of their type—use no outside pipes or ducts—are strictly portable. Ask us for Catalog D-9 and list of users. Make your own investigation.



Steam Coil Type SC

lizes live or exhaust im at any pressure. Port- e—can be installed by any mechanic.



Direct Fired Type DF

here steam is not avail- ble. Burns coal, coke, gas or oil.

Also a Ventilator

Due to a fundamentally different design Skinner Bros. (Baetz Patent) Heaters are excellent ventilators, either when used for this purpose alone or in conjunction with heating. Useful both winter and summer.

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SkinnerBros.
Baetz Patent HEATING SYSTEM

(*Continued from page* 35)

Executive: "Sorry, such experience may be helpful in other lines of work, but, you see, ours is a highly specialized concern, etc."—ad infinitum. Then, hesitatingly, "Well, we could employ you, but the salary will be 'X' dollars per month, and then after you have had some experience, we will put you in at a regular job. Take this letter to Smith and he will fix you up."

In the interim, it has been explained to the embryo engineer that his alma mater is held in high esteem by his new employer, and that there may be a great future in the game when his experience has become broader.

To many a college man, this kind of an induction into the business world does not stimulate his enthusiasm, but realizing his value as a producer, he is content with the wage, but—bring on the experience.

It may happen that this "cub" is placed to work under some older man, one who has been on the job a long time, years to the cub's days. Such older men are probably not academically trained, but they are on the job because of previous experience. Such previous experience is often acquired through learning the job under rule of thumb methods. Often this is essentially just running the job, or letting the job run them, or the job runs them in spite of their supervision. Should anyone dare to challenge the qualifications of such foremen they would be disposed of by the powers that be with dispatch.

If our technically trained man has benefited through his schooling, he has had a certain mental development, in spite of his fund of knowledge. This mental training has sharpened his ability to observe, remember, and think to a usable degree. The practical experience so necessary, can be taken in either of two ways.

He can work upon this so-called practical experience as an amplification or leavening of his academic training, and, as such, it will tend to round out his college work. In which event, each day's work will teach its own lesson, not so much a lesson as to how a thing may be done, or is done, in accordance with prescribed plant

Pounding Plibrico into place, to give a uniform jointless lining.



Here 91·4% of B.H.P. is Plibrico equipped

Richmond

PERHAPS nothing so clearly shows the wide use of Plibrico Furnace Lining as a survey recently made of the power plants in the hustling city of Richmond, Indiana. Here it was found that of the 54 boiler plants, 48 used Plibrico—a percentage of over 91.4 in rated boiler horsepower.

The reason for such extensive use, which is typical of the trend throughout the county? It's because Plibrico's long life makes it the most economical lining that can be installed.

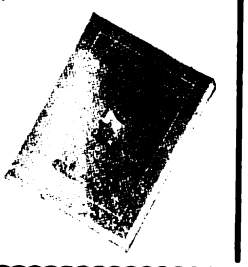
Plibrico has no joints. In consequence, it resists the attack of the flame far longer than fire brick. Two, three and even four year service without relining is not out of the ordinary.

Don't you want the big book, "Refractories and Furnace Design" that tells how Plibrico gives long service and in addition cuts down heat loss through the setting? Send the coupon for your copy.

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Plibrico is delivered only in steel containers of distinctive appearance as shown below.

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This big book is FREE
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Jointless Fire Brick Co., 1154 Clay St., Chicago.

Please send me the 32 page booklet "Refractories and Furnace Design"—no obligation.

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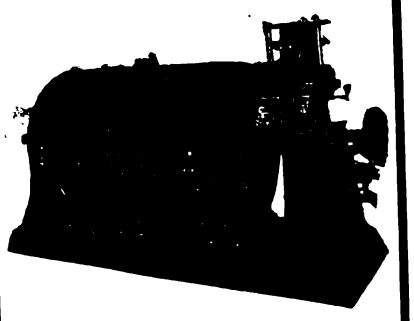
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The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway New York

practices, but why it is done, and done in such a prescribed fashion. To learn the fundamental features of the work does not require years of training, for the newcomer must, of necessity, advance provided his mechanical proficiency has kept pace with his mental activity.

On the other hand, the *why's* of plant practices may not occur to him, or he may accept them without question. His mechanical proficiency may develop after being taught the "ins" and "outs" but unless he has developed his gift-of-gab, his progress will be slow.

Under the proper observations, the man in the former situation further sharpens his wits, that is to say, his faculties of observation, memory and r a t i o c i n a t i o n have strengthened. Inasmuch as there is a continued demand for thinkers at the top, such a man progresses. However, in the latter situation, although there is developed mechanical skill and precision, the mentality is not stimulated. And lacking stimuli, possibly under such experience, the mental faculties, however keen initially, become dulled and in the course of time, must necessarily atrophy. Under this condition, a man soon loses ambition, contents himself with being a worker, having a job. He may be satisfied, until his college mates pass him on the ladder of progress and then, maybe, he inventories himself and finds a cure for his failure to make headway.

Contrast, if you will, some men who have had years of practical experience in running a job, and who because of faithful service rendered are promoted and sometimes placed in the executive offices with other men who have a marked degree of intelligence, yet not so many years of experience. Very often the man of practical experience does not respond to the situation, because, or maybe, in spite of his years of practical experience. Such years being years of service, have developed his hands and not his brain. The result is that such men first become elated on promotion and then discouraged, with a feeling that they are having a joke played on them by the management. Yet, in a carefully controlled organization, such occurrences are and

(*Continued on page* 42)

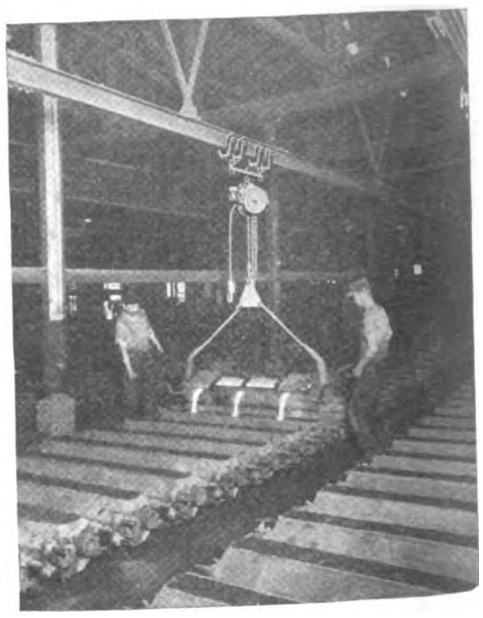
MOTORBLOC

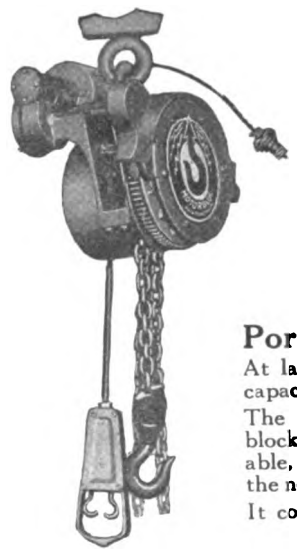
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SAVES Time Labor and Money

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Isn't there a possibility that the ***Motorbloc*** *can do the same in your plant,—regardless of your line of business? Write us.*





Portable and Mechanically Right

At last,—a real portable electric hoist. The one ton capacity hoist weighs only 140 lbs.

The **Motorbloc** is hung up like an ordinary hand block in any location where electric current is available, and is put into service by simply plugging into the nearest socket.

It consumes less than 10c. worth of current per day.

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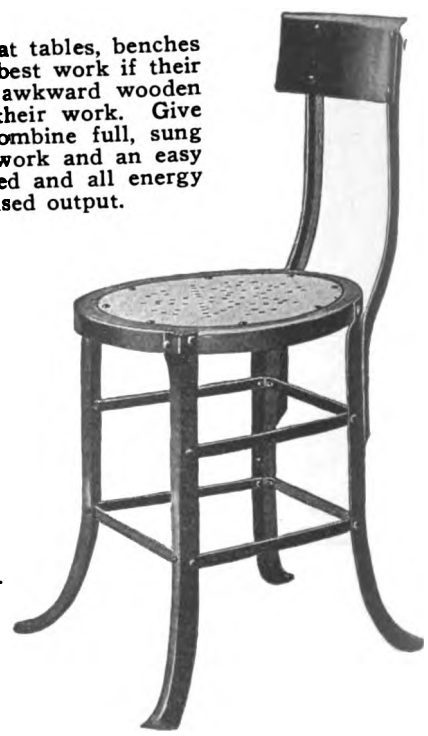
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Men and women who sit all day at tables, benches and machines—can they do their best work if their bodies are tense and tired from awkward wooden chairs? Such fatigue slows up their work. Give them comfort with chairs that combine full, sung back support, height to suit the work and an easy rest for the feet. Fatigue is saved and all energy used for work. The result—increased output.



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COSTS ARE LESS—

With all these advantages Meeco Steel Chairs cost you less than two cents per day per dozen with our five year guarantee. Could you buy good wooden chairs and keep them repaired five years for that price? The investment is an economy from the start. Get the new illustrated catalog. You'll find the Meeco Steel Comfort Chair will make better workers on your factory jobs. It means an increase in output you never realized.

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There are over 500 "American" Fixtures in the Drafting Rooms of the Allis-Chalmers Mfg. Co. at Milwaukee, Wis., of the type shown above.



6 STYLES
Ceiling Fixtures
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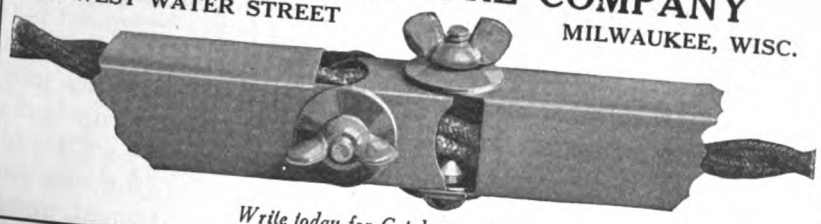
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That is the big thing that "American" Adjustable Fixtures accomplish when installed in your machine shop or factory. They bring the light to the work and enable higher intensities at low cost.

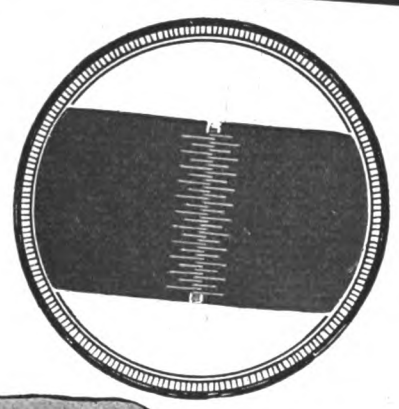
Its construction is very substantial. All conductor wires are enclosed in the fixture arms. The universal joints enable the operator to place its light in any position—and its stays put.

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The LAY policy of specialization in the manufacture of metal case brooms, inaugurated back in the seventies, provides for a special type of broom for each kind of factory. From wood-working shops to big constructing jobs, there's a LAY broom designed to do the job best and longest.



BROOMS
—*the primary tools of maintenance*

Without doubt, the first cliff-dwelling stone carver must have had his bundle of twigs or branches—his broom—standing beside the entrance to his cave, ready to clean out the chips and debris accumulated from his day's work. Throughout the ages the broom has been the primary instrument of maintenance in home and factory alike.

Individual brooms do not cost very much, but when bought in gross lots several times a year, they represent quite an item. Because of the high grade materials used in their manufacture, the constant inspection of quality during construction, and the policy of building a different kind of broom for each kind of industrial sweeping, LAY brooms will last twice as long as an ordinary variety. They will

Cut Maintenance Costs in this item 50%

Besides, each one is fully guaranteed.

Order your Winter supply now. Price list on request.

Originators of the METAL CASE BROOM

THE JOSEPH LAY COMPANY
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RIDGEVILLE INDIANA

Remember, we make a full line of brushes for every industrial purpose.

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must necessarily be a minimum.

It often happens that two men of the same general make-up start out together in a commercial organization, and after a few years find themselves far apart. In so far as mentality is concerned, the writer's observations are that the daily experiments of the one who advanced, taught him lessons from which he either consciously or unconsciously deduced certain fundamentals and placed them away for his future guidance. On the other hand, the fellow who was left at the post, failed to recognize a lesson in any of his daily experiments, and therefore, did not learn as did his co-worker. Now this latter man might have developed a "good line of talk" that would have disclosed to his superiors the feeling that he was a real go-getter, and then the conditions might have been reversed. Such lines of talk don't bear close scrutiny, and are generally superficial. Men of such experience as in the latter instance, hold their jobs by virtue of a long term of service, and possibly at some opportune time have made a hit with some one or more of the bosses through an accidentally staged grandstand play. This being the age of reaching conclusions through a very few—the fewer the better—observations, such a man is thrown into that class of good men from which future bosses are to be picked.

Let us return to our embryo engineer: Few of his employers recognize that his schooling has given him something on which to build, a foundation, that only a few of the untutored get after many years of work, and, therefore, after a period of training in a new line of work, at least enough to develop his necessary knowledge, he is really an asset. As such his remuneration and responsibility must be increased. It might be said that a young man may not have good judgment, but if his judgment is to be guided by facts versus opinion, and plain talk, his judgment should be superior to that of the untutored—with some exceptions. Yet, for such jobs which require judgment, wherein facts cannot be presented either in substantiation or otherwise, the utmost care should be used, and due allowance made for academic training.

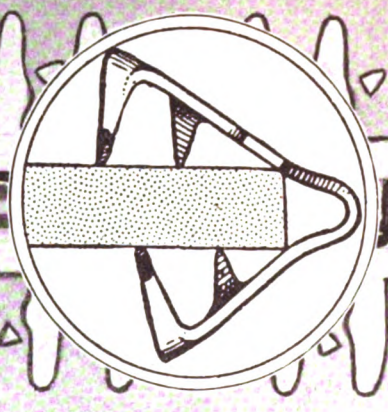
It seems that in the employment of new men, too much stress is unwittingly laid on experience, and not enough on intellect. The U. S. Civil Service appreciates this to some extent, when it allows four years' university work to be the equivalent of a certain amount of practical experience, but not very much. Many other employers realize that there is an advantage, but none have dared to publicly equate it. There are many men whose college training has been zero in the net, but the discussion of this is not within the scope of this article. The supposition is that if a man has had so and so much experience, he is very likely qualified for a job, and if the employer is not one who expects intelligent supervision on the part of his new man, such a man "gets by." In coming in contact with many men, it has been noticed that very often there would be two men on a job, one

(Continued on page 47)

ALLIGATOR

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How Lacing Can Lengthen The Service of Your Belts

The extra strength of ALLIGATOR STEEL BELT LACING means longer uninterrupted service. The teeth clinch through the belt end, compressing it in a grip of steel. It gives the weakest spot in the belt the greatest protection. The joint is flexible and separable. It is smooth on both sides and no thicker than the belt. Any good workman can make a long-lasting, efficient joint quickly and easily.

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For Every Size and Kind of Belt

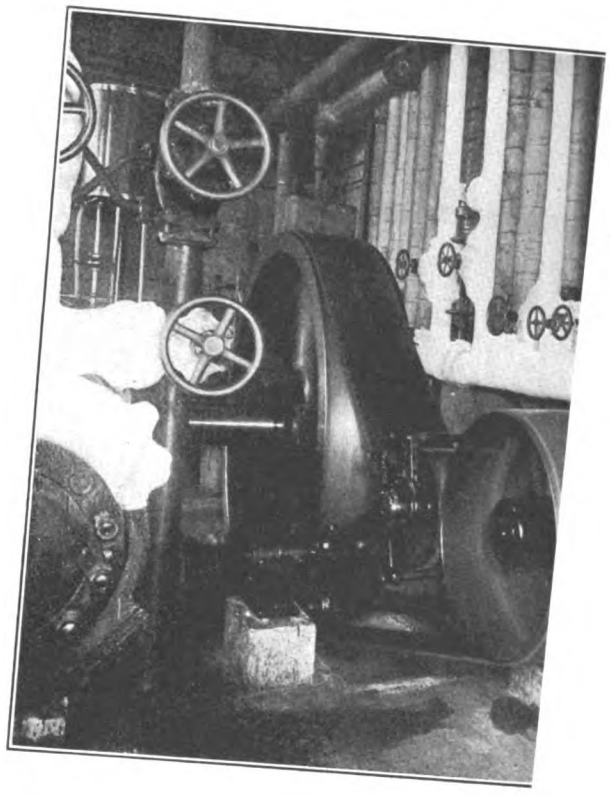




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ally for recording the pro-
ch presses, metal stamping
d other heavy-duty machin-
g stops limit the movement
to 45 degrees or 1/8 turn,
ters one on the dial. The
e figures are easily read ten
Counter is regularly fur-
five figure-wheels, and may
o zero by one turn of knob.
special fixtures for attach-
$18.00.

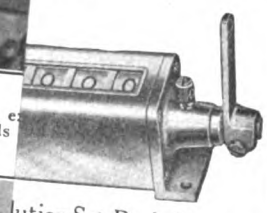
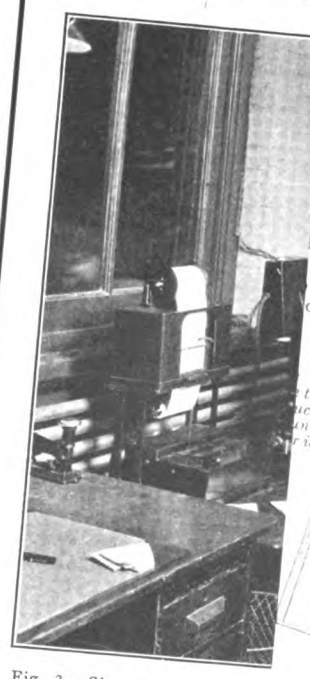


Fig. 2.—Showing employees, e
shown in Cut 1, which records



lution Set-Back Counter
ds the output of any ma-
a shaft-revolution indicates
n. Sets back to zero from
by turning knob once round.
ith from fo ur to ten figure
required. Price with four
ls, as illustrated, $10.00—
liscount. *Cut less than one-*
Set-Back Rotary Ratchet
record reciprocating move-
on punch presses, $11.50



Fig. 3.—Showing operator at
credit has been passed. Ther
applications for gas and elect

eeder Mfg. Co.

nt St., Hartford, Conn.

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must necessarily
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It often happens
men of the same ge
up start out togethe
mercial organizatio
ter a few years find
far apart. In so f
tality is concerned, t
observations are tha
experiments of the



t office taking application for service from foreign born
nglish, and transmitting same on Telautograph to Credit
se instruments are shown mounted upon a temporary
new location.



How

The
unintern
grip of s
joint is
belt. A

amining records to clear credit on applications taken as
on instruments both at main office and shop.



shop making up orders transmitted by Telautograph after
e is also shown on the right telephone order table at which
ric service, complaints and leaks are taken.

Sold at whole
retail the wo

"Every Tooth A Vise"

RECORD OF SHOP ORDERS

Transmitted by the Telautograph January 8, 1923, to show time between actual receipt of order and execution of same. This does not include leak and miscellaneous orders received by telephone at shop.

Telauto-graph Nos.	Nature of Order	TIME: Application made by Consumer	Credit Passed	Further Credit Investi-gation	Order Given to Bill Jones	Bill Jones Arrived at Premises	Elapsed Between Taking of Appl. and Arrival of Bill Jones Hr.	Min.	REMARKS
"A" Machine									
1	Spl. Test	8.49	....	....	....	....	..	..	To be done 1- 9-23 Bookkeeper only
2	G	9.20	9.21	....	....	....	..	..	
3	G	9.47	9.48	9.57	11.08	11.15	1	28	
4	Canceled								
5	Sales	10.00	10.39	....	12.00	1.35	3	35	Welsbach heater
6	E	10.14	10.15	....	12.00	1.00	2	46	
7	PS	10.17	....	....	11.21	1.35	3	18	CGI
8	Set G&E	10.18	10.19	....	12.00	5.05	6	47	
9	SG&E	10.19	....	....	12.00	....	..	..	To be done 1-15-23
10	Void								
11	G&E	10.25	10.26	....	....	....	..	..	To be done 1-20-23
12	ST	10.30	....	....	....	....	..	..	To be done 1- 9-23
13	G&E	11.00	11.01	....	12.00	1.30	2	30	
14	Spec. Elect.								
15	E	11.15	11.16	....	....	....	..	..	To be done 2-20-23
16	PS	11.18	....	....	12.00	1.50	2	32	
17	Complaint	11.20	....	....	12.00	4.00	4	40	
18	PS	11.20	....	....	12.00	5.20	6	00	
19	ST	11.21	....	....	....	....	..	..	To be done 1- 9-23
20	ST	11.38	....	....	....	....	..	..	To be done 1- 9-23
21	G&E	11.37	....	....	11.40	....	..	..	To be done 1-10-23
22	G&E	11.40	11.41	....	12.00	1.45	2	05	
23	SG&E	11.42	....	....	....	....	..	..	To be done 1-10-23
24	SG&E	11.45	....	....	12.00	3.00	3	15	
25	G&E	12.02	12.03	....	12.10	2.05	2	03	
26	Spec. Elect.								
27	Set G	12.19	12.30	....	2.42	4.00	3	41	
28	Set G	12.30	12.31	....	12.40	4.20	4	00	CGI
29	G&E	12.34	12.35	....	2.42	2.50	2	16	
30	PS	12.40	....	....	6.15	8.15	7	35	Wrong address
31	PS	12.40	....	....	3.00	3.40	3	00	
32	AR	12.45	....	....	....	....	..	..	To be done 1- 9-23
33	AR	12.47	....	....	12.50	3.20	2	33	
34	PS	12.48	....	....	....	....	..	..	To be done 1- 9-23
35	SG	12.50	....	....	2.42	....	..	..	To be done 1-15-23
36	G&E	12.56	12.56	....	....	....	..	..	To be done 1-10-23
37	ST	1.00	....	....	....	....	..	..	To be done 1- 9-23
38	Leak	1.40	....	....	1.50	2.30	..	50	
39	AR	1.46	....	....	....	....	..	..	To be done 1- 9-23
40	G&E	1.53	1.54	2.06	....	....	..	..	Bookkeeper only
41	G&E	2.06	2.07	....	3.27	4.15	2	09	
42	Spec. Elect.								
43	G	2.46	2.47	....	4.14	5.00	2	14	
44	PS	2.50	....	....	3.48	5.20	2	30	
45	ST	5.10	....	....	....	....	..	..	To be done 1- 9-23
46	ST	5.11	....	....	....	....	..	..	To be done 1- 9-23
"B" Machine									
1	SG	8.35	....	....	9.25	9.30	..	55	
2	PS	9.03	....	....	10.03	1.25	4	22	
3	G&E	9.09	9.10	....	10.23	8.30	..	..	Picked up by Bill Jones before disp'd
4	SG&E	9.10	....	....	10.23	9.30	..	20	
5	SG&E	9.25	....	....	9.55	10.30	1	05	
6	G&E	9.39	9.40	....	10.30	10.45	1	06	
7	SG&E	9.50	....	....	....	....	..	..	To be done 1-15-23
8	PS	10.00	....	....	....	....	..	..	To be done 1- 9-23
9	SE	10.24	....	....	11.10	11.20	..	56	
10	Void								
11	SG&E	10.40	....	....	....	....	..	..	To be done 1-15-23
12	Spec. Elect.								
13	G&E	10.48	10.49	....	12.10	2.30	3	42	
14	Leak	10.52	....	....	10.55	....	..	..	St. leak—Ref'd to Street Dept. 1 p.m.
15	SG	10.58	....	....	12.00	2.45	3	47	CGI

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Reduced the time on completed operations from two days to two hours and forty-eight minutes!

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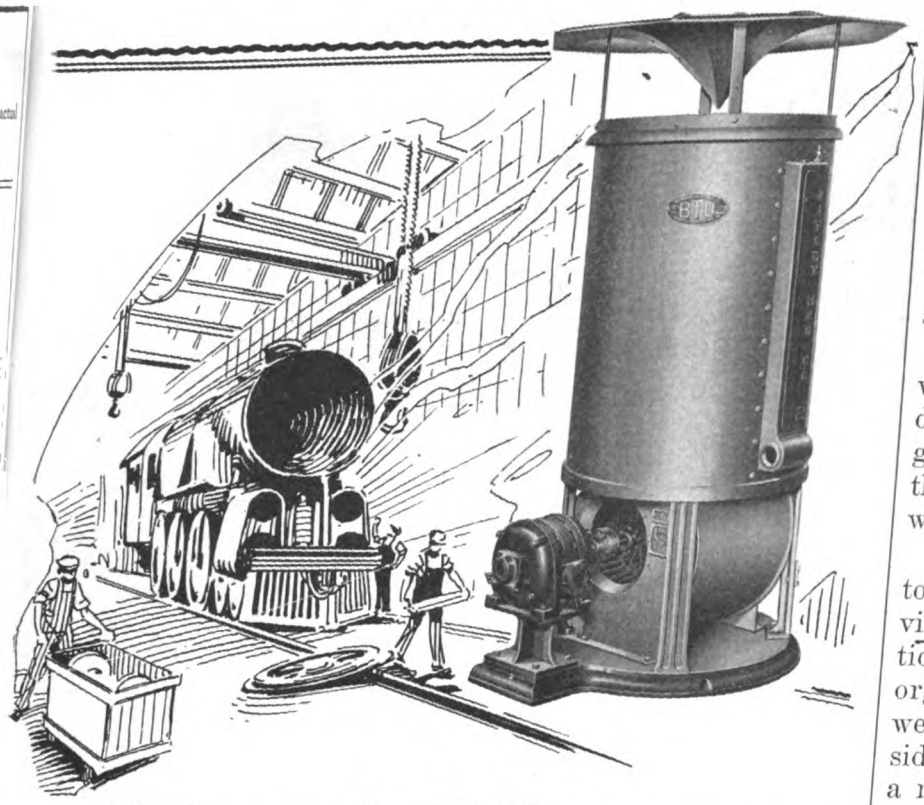
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found itself confronted with the problem of providing efficient and flexible heating and ventilating facilities for its various repair and maintenance shops and solved that problem, after extensive investigations by purchasing and installing

43 Bayley

B. T. U. HEATERS

The B.T.U. is a complete self-contained heating and ventilating unit that draws the cold air from the flooring through a series of steam coils and distributes the heated air evenly through the entire room. It is made of steel and iron throughout and requires no distribution duct system. Simply set on floor, connect supply and return piping and wiring to motor and it is ready to operate. Made with a variety of distribution hoods that make it especially suitable for heating industrial and railway shops and for temporary installations where properly distributed heat and flexible ventilating facilities are essential.

Write for descriptive folder

Bayley Mfg. Co.

Dept. P. Milwaukee, Wis.

(Continued from page 42)

with two or three years' experience, and another with eight or ten years' experience, and the man with the shorter service, not being immune to the contagion, is head and ears better than the good old experienced war horse. Such a fact needs no psychological analysis.

The feature of experience which develops men, capable of development, is not the daily grind of running a job, but of the emergencies or casualties which are encountered.

Why has it been the custom to place so much stress on previous experience for promotion, or even induction into an organization. The reason may well be because after some considerable practical experience, a man's mind has been acted upon to the extent that it has been stimulated and even though receiving no parallel academic training, as such, his intelligence has been quickened, and has learned the fundamentals which are the foundation on which to build. He, therefore, should be the better man by virtue of this something called experience. But sad to relate, many have been exposed to this peculiar something, and have come out unscathed; they were initially immune, and equally sad such men are made bosses, because they have had the experience. There are men in supervisory jobs, and this includes some college men as well, who are hardly one degree better off today through their years of experience than the day they first started to work. They can dress well, appear cultured, and affect an intelligent air, but they would faint at the least intimation of an intelligence test, were such a test really reliable.

Years are spent getting experience, and strange to say, no one has ever pointed out just where or when it is to be used. It little matters in particular the detail nature of this something called experience. The main issue is that it be gotten, and through getting it, it be made to develop the intellect as well as the hands, while, if the development of one or the other must be sacrificed, let it be the hands. The ratio of manual workers to thinkers is always greater than unity.

Pieces-per-Hour Prove What's Up!

Are you getting *ahead* with the practical handling of this or that machine?

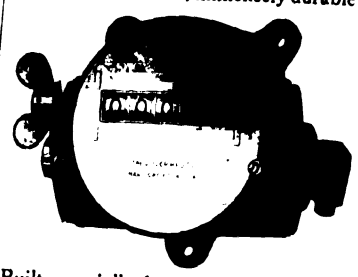
Are you getting larger production with each change in mechanical adjustments, speeds and feeds?

Is the operator of the machine getting *his* methods down fine?

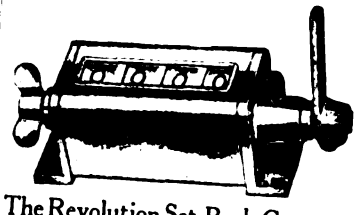
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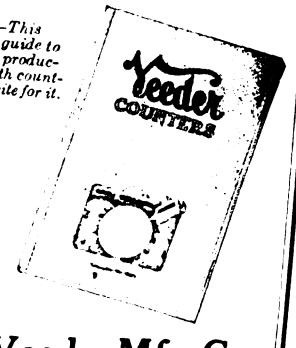


Built especially for recording the product of punch presses, metal stamping machines and other heavy-duty machinery. Strong stops limit the movement of the lever to 45 degrees or ⅛ turn, which registers one on the dial. The large, legible figures are easily read ten feet away. Counter is regularly furnished with five figure-wheels, and may be *set back to zero* by one turn of knob. Requires no special fixtures for attaching. Price $18.00.



The Revolution Set-Back Counter above records the output of any machine where a shaft-revolution indicates an operation. Sets back to zero from any figure by turning knob once round. Supplied with from fo ur to ten figure wheels, as required. Price with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, $11.50 (list).

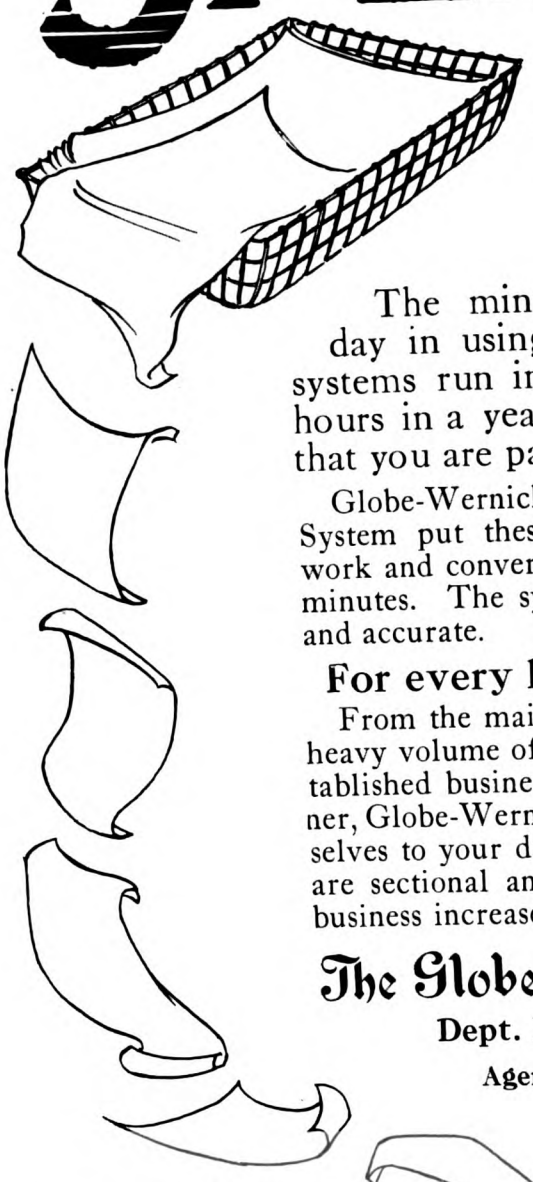
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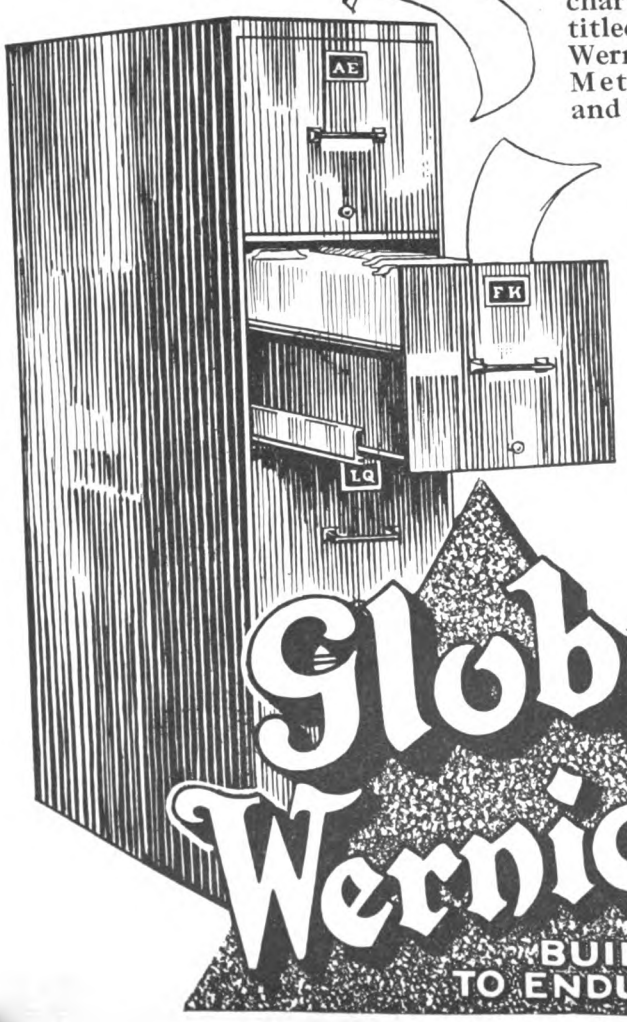
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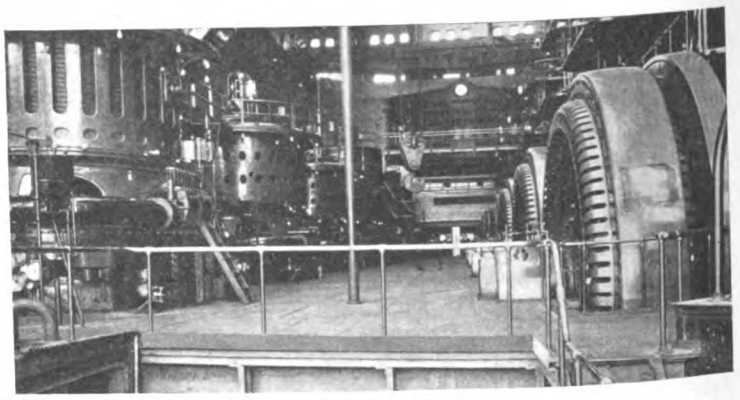
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Making the Factory Ceiling Pay Dividends

(*Continued from page 26*)

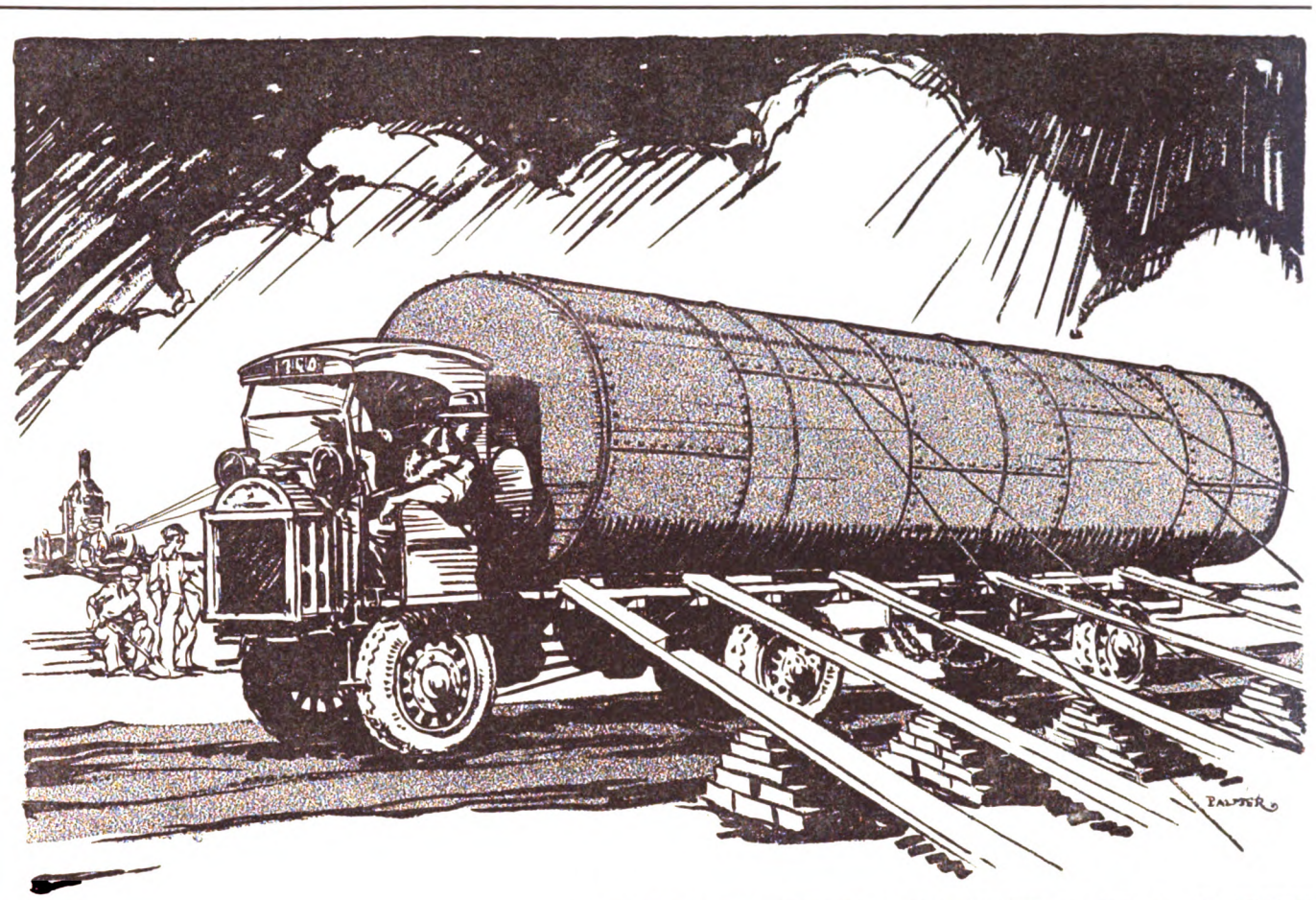
st, figures 23, 27, 28, 29, etc. e operator rides with these chines and controls all the ctions from the cab. Cab-rated telphers are em-yed where the equipment is ed upon to do considerable velling and where the ca-ity is large, necessitating high travelling speed or ere the distance per trip is ficient to permit high speed. There are many different es of tracks or monorail struction from I-beam to cial section. In most cases, vever, the point is to have load riding on two wheels flanges. Some of the tel-ers and trolleys ride directly the I-beam flange, but then siderable wear is incurred d frequently these I-beams ve to be renewed. Some nufacturers, therefore, fas-T-rails to the bottom nges of the I-beams, espe-lly where heavy loads are ried and telphers are used. the case of simple trolley-norails, a special built-up tion is the rule.

Switches and curves are the st difficult points in this stem of transportation. The itches are generally hand-erated, and it is necessary bring the telpher or trolley a stop before passing rough the switch. Switches e generally of the stub type, which the whole switch is rown from the main line to e branch track. These itches are made in either o or three directions from e main line. This gives ex-llent flexibility to the sys-m. In the case of telpher-onorails, some switches have en designed so that the vitching can be done by the perator in his cab, and it is ot necessary for him to bring ie monorail to a halt in order throw the switch. The ethod of operation in this ase is not intricate and has een developed to a point here it is quite positive, and ecause of the many safety eatures, there are now many f these automatic switches in peration. The main point to onsider in switches, is perfect lignment.

When using electric power or propelling the trolley or elpher, it is necessary to pro-ide conductors along the line of monorail travel. These are usually held in position by special equipment, and contact is made by means of a sliding show in very much the same way as the subway third-rail system is operated, figure 29. Sometimes ordinary trolley wire is used, figure 30, and there are various other types of conductors on the market.

Monorail systems are most efficient when travelling in straight lines and on the level, although if necessary, they can be made to operate on a 5% grade without much difficulty. In the case of some of the hand trolleys, a retarder is installed so as to permit transportation by gravity, but in this case it is usually necessary to install a power conveyor to engage the trolley when running the load uphill.

Curves should be as large as possible, particularly where



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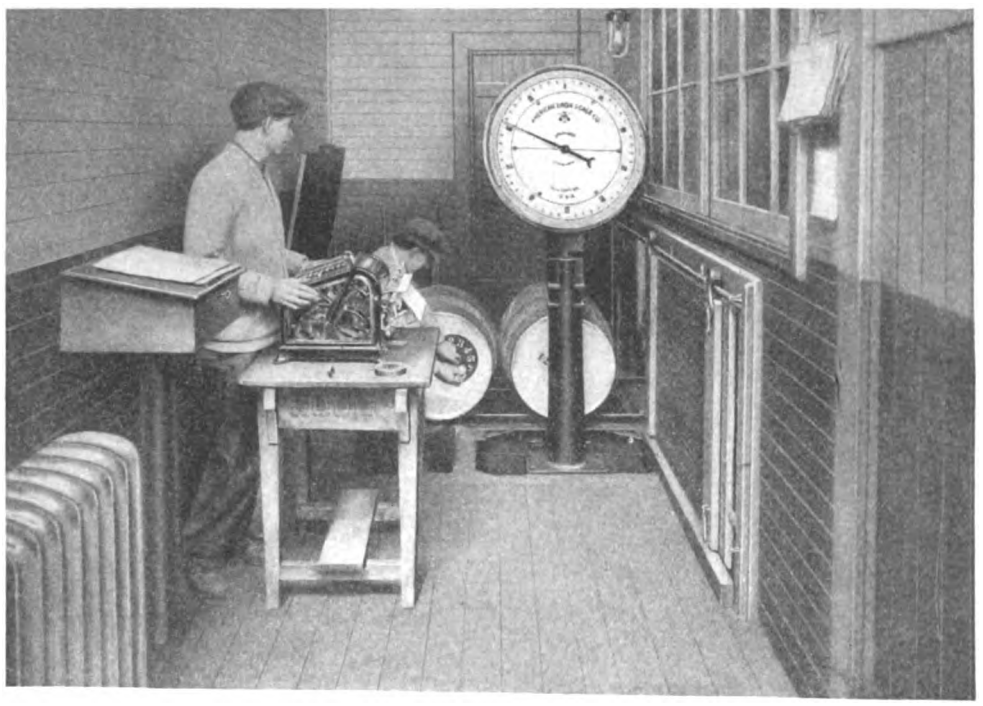
telphers are used. It might be said at this point that some of the first unsuccessful installations of monorail systems were due to curves and switches. There was a tendency on the part of some manufacturers to try and make a small radius curve in order to be able to perform certain operations and to get around obstructions. Short curves can be made on light equipment, as that shown in figures 1, 3, 5, and 15, or it might be said where only trolleys are used, but where monorail construction is heavy, and telphers carry the load, it is necessary to have large radius curves, in order to reduce friction and permit the equipment to take these curves at a fairly high rate of speed. The track supports, as shown in figures 21 and 29, should be widely spaced at the curves, so that the line of travel of the telpher can be free of obstructions. The reason for this is that if the load is travelling at an appreciable speed, there is a certain amount of centrifugal action on the load, which tends to swing it out, and for this reason ample clearance should be given.

The old type of switch was more or less of a makeshift, and seldom stood up after being in operation for a short length of time. The result was that trolleys jammed at switch points, and telphers travelling at high rates of speed frequently became wedged, causing serious delays, and as some of the first installations were not provided with safety devices, the result was that accidents occurred by telphers running off open ends of tracks and through open switches, where the switch had been thrown after the operator had passed.

Today, however, switches have been perfected for both the trolley and telpher, and have been provided with all the necessary safety devices to eliminate accidents at these points.

To show what can be done by trucking on the ceiling, with this equipment, we will look at figure 1. This view is taken in the foundry of the Redington Standard Fittings Co., of Redington, Pa. Those who are familiar with foundry operation realize the necessity of using every foot of floor space, and at the same time of being able to get the metal to the moulds with the least amount of man effort. The overhead monorail is of the light construction type, and the tracks are so placed that every foot of floor space can be served. The handles for throwing the various switches can be seen to the right, and to the left of the main line from the cupola. There was no record kept of the savings made by installing this equipment, but production was speeded up considerably, and better working conditions were some of the direct benefits.

As pointed out in previous articles, it is not always the money saving that should govern the installation of materials handling equipment, but working conditions should be given every consideration, and the dependability of the equipment over manual labor is a deciding factor. Time is saved and production is appreciably increased if operators at machines are provided with dependable hoisting facilities. All the necessary lifting can



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THE New National Rocker-Lift Elevating Truck embodies a triumph of scientific handle leverage. This tremendous leverage is applied at the most vital moment of the lift—at the first pull on the handle—when the complete inertia of a heavy load must be overcome.

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Moreover, lifting or lowering is accomplished with equal celerity and safety, whether the handle is facing front or either side. This is a great advantage in narrow aisle work.

When in process of elevating the top side-bars move forward until they rest on heavy lugs that are shaped onto the side members of the Kick-off bar. Thus the load is solidly supported on both sides. To lower the load the Kick-off bar is stepped on and the load descends under control of a powerful, hydraulic check.

The illustration gives some idea of the heavy, powerful construction of this new truck.

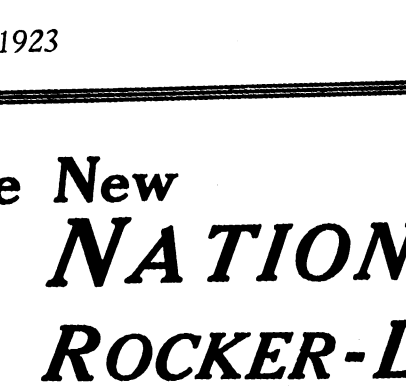
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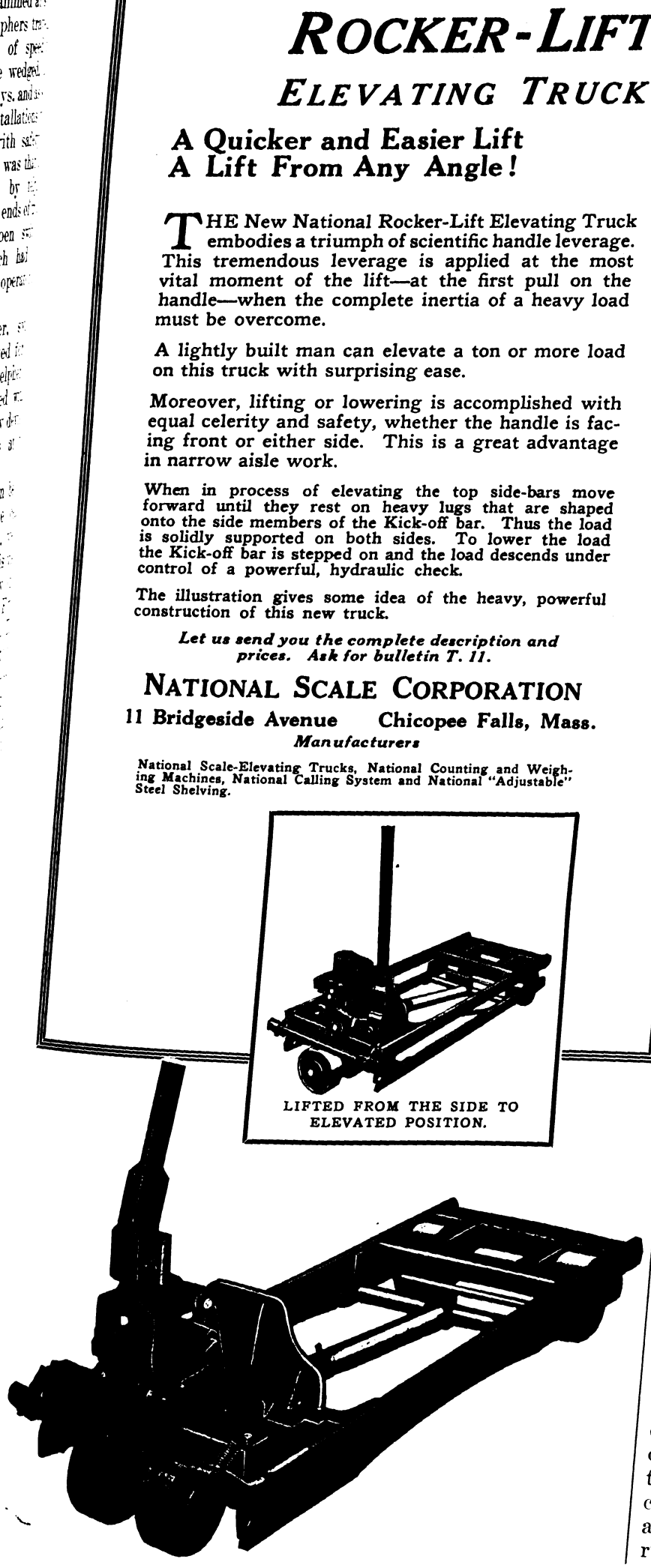
11 Bridgeside Avenue Chicopee Falls, Mass.

Manufacturers

National Scale-Elevating Trucks, National Counting and Weighing Machines, National Calling System and National "Adjustable" Steel Shelving.



LIFTED FROM THE SIDE TO ELEVATED POSITION.



then be done by one man, without his calling other operators from their work.

The policy of the Manhattan Rubber Company is to give each man all the mechanical help possible, to secure the highest efficiency in the performance of his particular job, and the hoist shown in figure 6 is a mechanical helper equal to the task of lifting 1,000 to 1,800 pound rolls of rubber, into 24" to 66" calenders. The service is severe, being constant for 24-hour duty, with approximately 180 lifts a day. They are not costly to operate, and they stand up under severe service.

Plant executives are now beginning to grasp the advantages of providing mechanical help wherever possible. Even the small shops are following this same procedure, and garages are using electric hoists and trolley monorails as shown in figure 7. There is no need of lying down under the car and working in cramped quarters, when the work can be elevated as shown. Note the adjustable stands and removable bench for tools to work with while under the car. Practically half the time on repair jobs was saved by installing this equipment, because of the greater amount of light and the convenience of getting at the various nuts and bolts.

It is of course always desirable to show something more than better operating conditions, and the steel warehouse of the Edgar T. Ward Sons' Company, of Brooklyn, have found that four monorails equipped with trolleys and chain hoists produced a savings of two men's wages, and increased the storage space 50%, as by lifting the load by chain hoists, they could pile the material higher. The total amount of material conveyed each day of nine hours in this warehouse was from 45 to 50 tons, only four men being required. Thus labor costs were cut in half and time reduced by 50%, (figure 8).

Materials handling equipment, whether it be trolley and telpher monorails, elevators or conveyors, is not limited in its adaptation to any one industry. The illustrations accompanying this article show this equipment operating in foundries, car shops, rubber plants, automobile re-

Rapid Action Valve

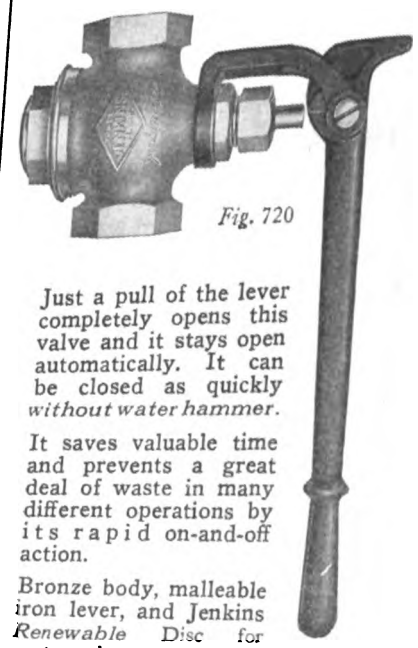


Fig. 720

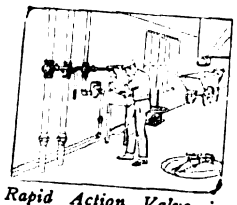
Just a pull of the lever completely opens this valve and it stays open automatically. It can be closed as quickly *without water hammer.*

It saves valuable time and prevents a great deal of waste in many different operations by its rapid on-and-off action.

Bronze body, malleable iron lever, and Jenkins *Renewable* Disc for **water, air, steam, or oil. Send for folder describing this valve and its uses.**



Rapid Action Valve in use on cooking vats in canning factory.



Rapid Action Valve in oil, air, and steam lines to generating set in gas plant.



Rapid Action Valve used in washing barrels in cooperage plant.



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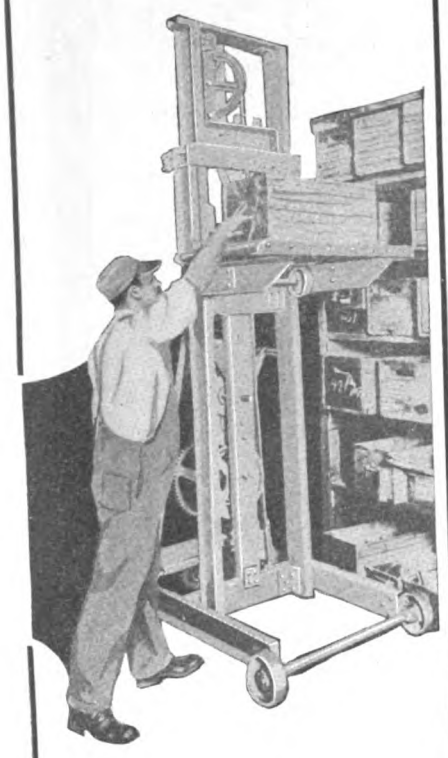
Jenkins Valves

SINCE 1864

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7 Ways



Seven dominant reasons WHY

Lewis-Shepard Heavy Duty Electric Worm Drive Stackers should be your first choice.

(1) Worm Drive—operating in oil bath
(2) No exposed gears
(3) Lifts Easier
(4) Greater Rigidity
(5) Greater Safety
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(7) Lives longer and gives more satisfactory service.

We also make hand operated Stackers and combination (hand and electric) stackers.

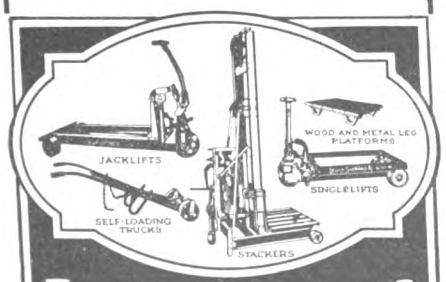
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BOSTON

pair shops, warehouses, piano factories, moving picture studios, tanneries, new construction work, concrete block plants, automobile assembly departments, pottery works, copper refineries, glass warehouses, coal storage yards, lumber yards, piers and sheds, plant yards, paper mills, glue factories, fertilizer plants, and these are only a few of the various industries where this equipment has been successfully used.

Consider how difficult it would be to handle the pianos shown in figure 9, by any form of truck, and the amount of space it would require if they were left on the painting benches to dry. It is a saving of valuable floor space that often brings about the installation of materials handling equipment, but in the case of figure 10, in the Fox Film Corporation, it was a case of ease of handling and quick shifting of sets which caused the installation of the trolley-monorail.

Plant executives who have a knowledge of materials handling equipment, or who will investigate the various types of equipment on the market, do not only save money by cheaper operation, but frequently save money on the initial installation. The Sopar Company, at Philadelphia, used to receive the raw paper, from which they manufactured tickets and tags, in 500-lb. boxes. These were formerly raised to the second floor on a hand operated elevator, and it took two men 15 minutes to unload a box, load it on the elevator, raise it to the second floor, and unload it. As these boxes often came 25 at a time by truck, the unloading of them held up production, because the same elevator was used for other purposes. The installation of an electric hoist attached to a trolley-monorail, extending outside of the building, as shown in figure 11, has saved considerable time and money. It now takes only three minutes for one man to unload and hoist a box of paper, which saved $108 a year on labor alone; but the biggest advantage is more even production, and freeing the elevator for other purposes for which it is more adapted. Before installing the electric hoist, they had considered the installation

(*Continued on page* 54)

THE CASH VALUE OF AIR

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HEATING AND VENTILATING
GENERATOR COOLING
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ZERINGS PERFECTION WORLDS STANDARD OF QUALITY HAND PROPELLED VEHICLES

CHAMPION ADJUSTABLE CASTERS CUT TRUCKING COSTS

Trucks equipped with the new ZERING Adjustable Double Race Casters handle heavier loads with less labor effort and save tremendously on trucking costs.

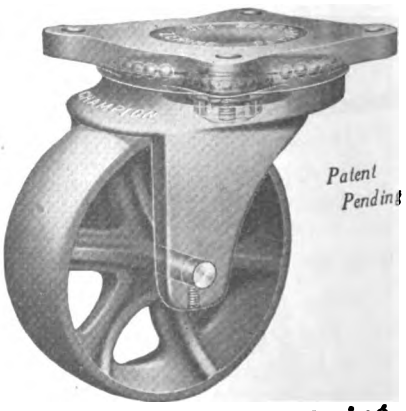
Champions are long wearing, free swiveling, practically frictionless and not affected by side thrusts.

A simple adjustment takes up all wear in ball races without removing casters.

Champion equipped trucks are always ready for service at practically no maintenance expense.

You'll never see a neater, sturdier caster—there are no projecting bolt heads, nuts or cotter pins.

ZERING Champions are made in all sizes to suit every truck. Send for caster bulletin today.



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For Moving Bulk Materials With Economy and Speed

We design, manufacture and erect
Belt Conveyors,
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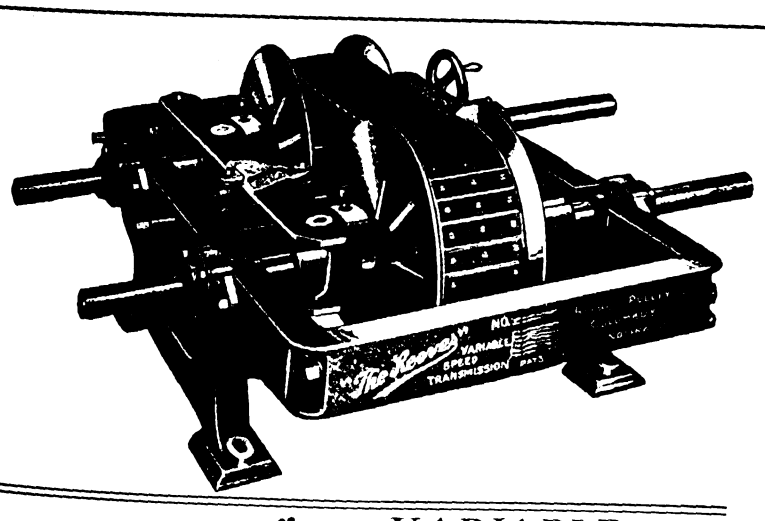
A Robins System has met practically every requirement of economical bulk material handling.

With the Company's experience of over twenty-five years to guide him one of the Robins Engineers can efficiently co-operate with you in designing and installing equipment to meet your requirements.

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"The Reeves" VARIABLE SPEED TRANSMISSION

WHAT IS IT?

A compact, mechanical device for application to any machine or conveyor on which variable or adjustable speeds are desired. May be installed on floor, ceiling or platform between the source of power and the machine to be regulated. Complete variable power unit can be furnished with motor attached.

WHAT WILL IT DO?

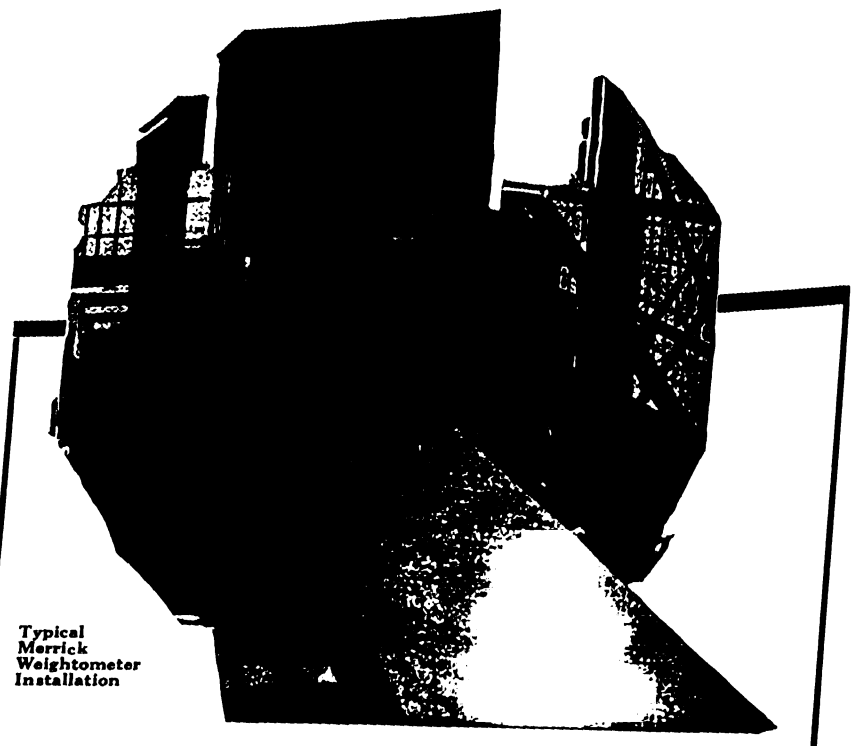
It will enable the operator of the machine to secure the correct speed for the material in operation. Any one speed may be maintained indefinitely or the speeds may be changed as often as necessary.

Provisions are made to operate the Transmission by handwheel, sprocket and chain, electrical remote or automatically.

Over 25,000 in operation. Sizes 1 to 150 HP.
Speed Variations, 2 to 1 up to 16 to 1.

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Typical Merrick Weightometer Installation

Weighs and Records Automatically

Conveyor Handled Materials

As the materials pass over the conveyor, the weight is recorded immediately by the Weightometer.

No labor required—

Accuracy guaranteed 99%

You can know exactly how much material you receive and ship with the

The MERRICK CONVEYOR Weightometer

is in use in hundreds of plants for weighing Coal, run o'mine and crushed; Coke, Stone, coarse and fine; Gravel, Sand, Cement Rock, Phosphate Rock, Phosphate Pebbles, Wood Chips, Sulphite Pulp Slabs, Fish and Fish Products, Ores, etc.

MERRICK Conveyor Weightometer

The "Merrick Circulars" contain graphic illustrations of various installations. Why not write for them to-day. There is absolutely no obligation.

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WEIGHS WHILE IT TRAVELS

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(*Continued from page* 52)

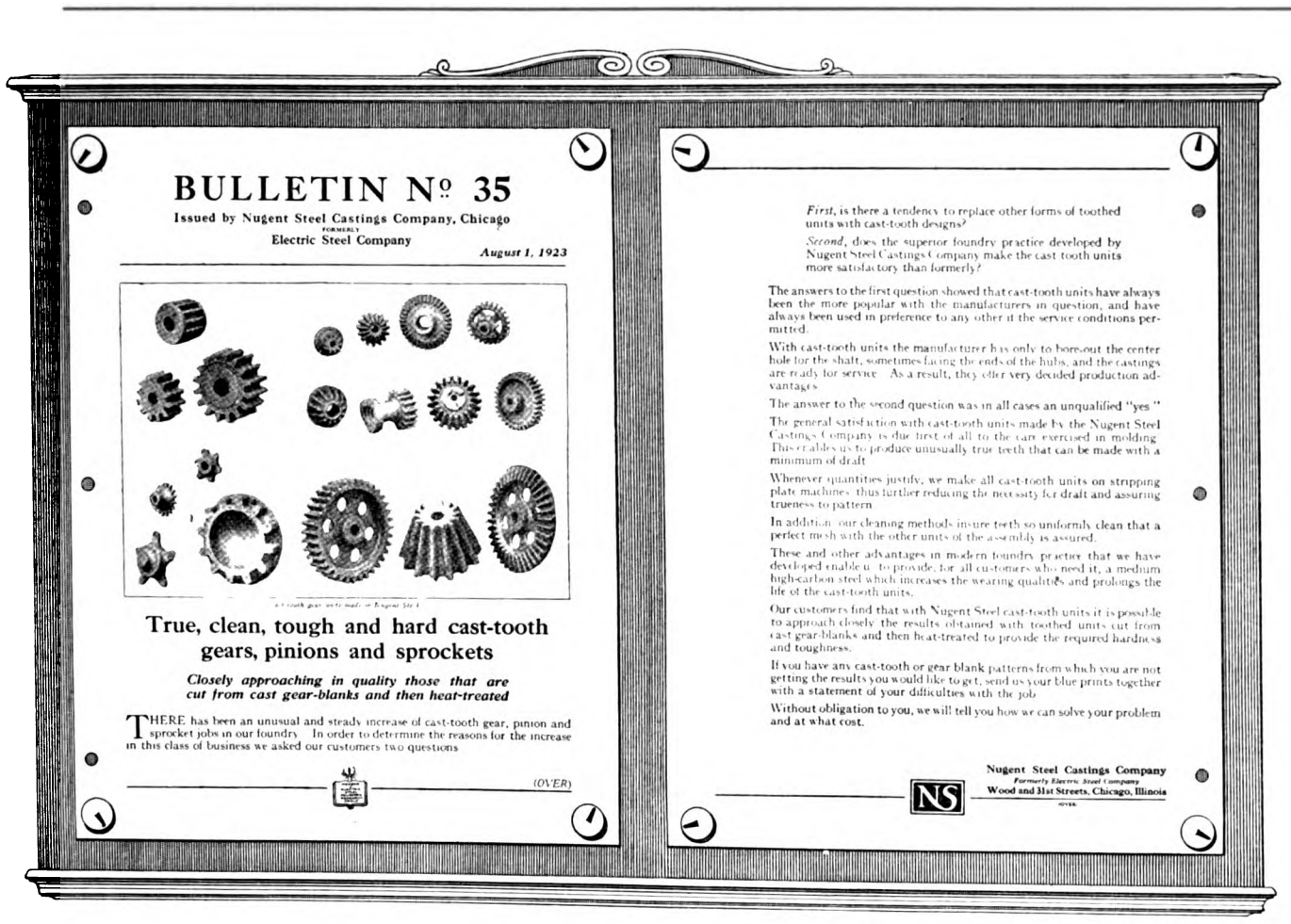
of a power elevator, which would have cost in the neighborhood of $2,500, but by installing the equipment as shown they saved $2,200 in investment, and the operating cost of the hoist is also considerably lower than the operating cost of a platform elevator.

These are startling figures, but there are so many instances of this nature that there is a tendency to overlook them, thus thousands of dollars are wasted annually..

The readers can get an idea of the various types of hoists, monorails and telphers from the accompanying illustrations. Figure 1 shows a chain hoist attached to a simple trolley, operating on a special monorail section. Figure 2 shows a chain operated trolley, operating on an I-beam monorail, and equipped with a special hoist supporting beam, which permits the hoist to be run into and out of cars, locomotives, etc. Figure 14 shows an electric hoist fastened to a trolley, operating on an I-beam monorail, while figure 16 shows an electric telpher operating on an I-beam monorail with an additional monorail and trolley for supporting the control mechanism, instead of having the operator ride in a cab.

Figure 23 shows a cab-operated telpher-monorail, while figure 24 shows a cab-operated telpher-monorail acting as a locomotive, and pulling two trailers equipped with electric hoisting units. Figure 26 shows an electric telpher, to which a cab is attached, supported by a trolley. Figure 26 shows very clearly the use of a transfer crane in connection with the monorail system. It would be very difficult to equip this plant with the necessary curves and loops in order to serve each machine, but the use of a transfer crane running in a longitudinal direction is able to serve a number of tracks running transversely. These monorails can be seen to the left of the illustration, directly over the machines. Movement of the transfer crane is controlled entirely by the telpher operator without him leaving the cab. By automatic safety stops, perfect alignment is assured between the short transverse tracks and the transfer crane.

It will be noted that the telphers usually run on heavy I-beam sections, while the trolleys can operate on either I-beam sections or special built-up sections of rail. These illustrations show clearly that monorails and telphers can be used in many industrial operations where some method of quickly lifting and transporting the materials to various parts of the plant is essential. The character of the work required of these hoisting and transporting machines in many of the processes of manufacture, precludes the use of overhead travelling cranes, especially in cases where comparatively light objects must be moved from one department to another. In this instance, some form of hoist and travelling unit, or a monorail has been found best adapted to the work; the monorail, being supported from the ceiling or other overhead portion of the building, may be installed without interfering with operations in the area underneath, and is therefore particularly applic-


BULLETIN Nº 35

Issued by Nugent Steel Castings Company, Chicago
FORMERLY
Electric Steel Company

August 1, 1923

True, clean, tough and hard cast-tooth gears, pinions and sprockets

Closely approaching in quality those that are cut from cast gear-blanks and then heat-treated

THERE has been an unusual and steady increase of cast-tooth gear, pinion and sprocket jobs in our foundry. In order to determine the reasons for the increase in this class of business we asked our customers two questions

(OVER)

First, is there a tendency to replace other forms of toothed units with cast-tooth designs?

Second, does the superior foundry practice developed by Nugent Steel Castings Company make the cast tooth units more satisfactory than formerly?

The answers to the first question showed that cast-tooth units have always been the more popular with the manufacturers in question, and have always been used in preference to any other if the service conditions permitted.

With cast-tooth units the manufacturer has only to bore out the center hole for the shaft, sometimes facing the ends of the hubs, and the castings are ready for service. As a result, they offer very decided production advantages.

The answer to the second question was in all cases an unqualified "yes."

The general satisfaction with cast-tooth units made by the Nugent Steel Castings Company is due first of all to the care exercised in molding. This enables us to produce unusually true teeth that can be made with a minimum of draft.

Whenever quantities justify, we make all cast-tooth units on stripping plate machines, thus further reducing the necessity for draft and assuring trueness to pattern.

In addition, our cleaning methods insure teeth so uniformly clean that a perfect mesh with the other units of the assembly is assured.

These and other advantages in modern foundry practice that we have developed enable us to provide, for all customers who need it, a medium high-carbon steel which increases the wearing qualities and prolongs the life of the cast-tooth units.

Our customers find that with Nugent Steel cast-tooth units it is possible to approach closely the results obtained with toothed units cut from cast gear-blanks and then heat-treated to provide the required hardness and toughness.

If you have any cast-tooth or gear blank patterns from which you are not getting the results you would like to get, send us your blue prints together with a statement of your difficulties with the job.

Without obligation to you, we will tell you how we can solve your problem and at what cost.

Nugent Steel Castings Company
Formerly Electric Steel Company
Wood and 31st Streets, Chicago, Illinois

(OVER)

How modern steel founding helps to reduce manufacturing costs

The drive for lower costs

ONE sign of the efforts of manufacturers to reduce the costs of producing certain types of machinery is the increasing number of cast-tooth gear, pinion, and sprocket jobs in our foundry.

Cast-tooth units replace cut units

Many engineers have found that expensive cut gears are no longer necessary.

Advances in steel founding such as those effected by the Nugent Steel Castings Company have made it possible to use cast-tooth gear units in many assemblies where cut gears were formerly used.

The cost advantages of the cast-tooth units include not only the elimination of cutting, but also a very considerable reduction of machining costs.

Send for these Bulletins

Bulletin No. 35, reproduced above, is one of a series of 41 describing recent advances in the art of steel founding and the research and other developments of the Nugent Steel Castings Company.

This D series of bulletins will be sent free to anyone requesting it on business stationery.

Nugent Steel Castings Company, Chicago, *formerly* Electric Steel Company

NUGENT STEEL NS

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in places as shown in s 1, 8, 18, 22, 23, 26, 32. the transporting of ma- s between buildings, it is imes impossible or too sive to provide the neces- concrete roadways for the f industrial trucks. Be- the line of travel is not t between points, it is im- ble to install conveyors. is another place where pplication of a trolley or er monorail system will ound advantageous.

gure 15, shows the yard ge of concrete blocks in E. Hamilton Sons plant of oit, Mich. It shows how lley-monorail is used and one carrier transports 45 s at a time. The struc- is erected of wood, and not expensive, when com- d with the cost of grading putting in a concrete road- for industrial trucks. It ld be noted how many ches occur in the main line, s to allow free entry into manufacturing building.

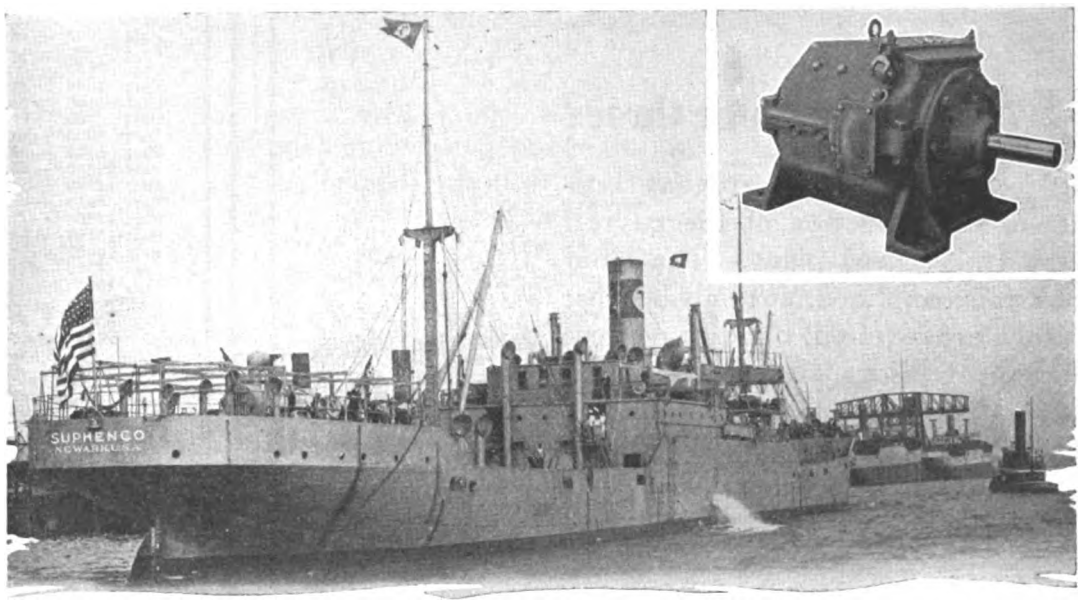
n other application of orails and telphers is in loor yard storage, either coal or lumber, where it ld be again impossible or expensive to put down the essary roadway for trucks. tallations of this character shown in figures 25, 27, 29, 31, and in the plant of the kering Lumber Company, Haslan, Texas, the use of rhead structures and tel- r monorails similar to se shown in figure 30, have de it possible to handle ber at a cost of approxi- tely 6 to 12¢ per thousand rd feet. The cost with d labor and horse trans- rtation varied from 50¢ to 00 per thousand board feet. addition, there was a con- lerable saving by installing overhead carrying struc- re instead of roadways.

It is somewhat difficult at st to justify the use of trol- and telpher-monorail sys- ms, as the engineer and plant ecutive is always looking for e possibility of using a con- yor, in order to obtain the lvantages of a continuous ca- acity, instead of the intermit- nt carrying which is neces- arily the case when this equip- ent is used. There are, how- ver, cases where the monorail positively the most applic- ble and most economical piece f equipment to be installed. There is a successful and strik- ing illustration of this equip- ment at the warehouse and pier of the Warner Sugar Refining Company, Shadyside, N. J., where a number of telpher- monorails are used for hand- ling the sugar in bags from shipside to warehouse and from warehouse to refinery conveying equipment, where the bags are opened and the raw sugar discharged. These monorails are not only used for transporting the load, but they are arranged in such a way that they elevate the load, and thus eliminate the extra handling on piling. It would be impossible to handle the sugar on this pier and ware- house with any other type of equipment as economically as it is being handled with a tel- pher-monorail system.

In pier work, telphers are frequently used as locomotives, and the train consists of a power driven telpher, and two or three trolleys, having a total capacity of about four tons when fully loaded; figure

(*Continued on page 57*)

SKF



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Need No Attention Prior to Unloading at Port

SUBMERGED for limited periods when the green seas come aboard and tilted at various angles when the vessel rolls, the electric motors for driving cargo hoists and winches on this ship must be fully protected against water and leaking oil.

So effectively are these unusual conditions met with Skayef self-aligning ball bearings operating in specially designed housings that no attention such as plain bearings require prior to unloading at a port is necessary. The special design of bearing housing positively prevents water coming in contact with the bearings and also prevents oil from over flowing into the motor frame.

Added to these advantages are the maintained precision and high load carrying capacities for which SKF marked ball bearings are noted. It is because of the superior service received from this type of bearing that it is so extensively used on industrial, marine and automotive machinery of all kinds.

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Ten cars of coal—or nine?

Ten per cent of the total coal burned is a conservative estimate of the saving of automatic stoker installations. In addition to this economy is the saving effected by burning the cheapest coal in the local market—coal that is always available.



Five men or three?

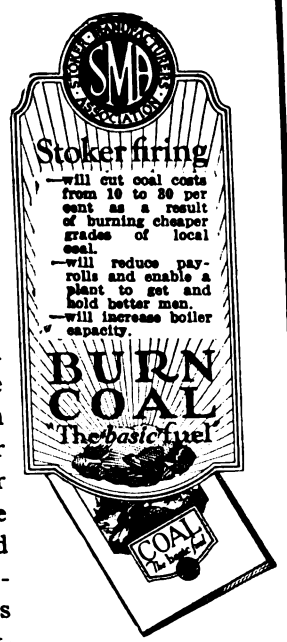
This is an equally conservative estimate of the reduction of the payroll in the stoker fired plant. The labor problem is simplified, not only because less men are required, but also because working conditions are so greatly improved that it is possible to employ a better class of men who become fully satisfied with their jobs.



Four boilers or three?

In many plants, particularly where wide fluctuations and sudden "peak" demands for steam are encountered, the ability of the stoker-fired battery of boilers to deliver a far greater amount of steam enables the load to be carried with fewer boilers than would be necessary with hand firing. Where plant expansion has made necessary a greater amount of steam for power or processes, it is well to determine whether the installation of stokers will enable the existing boiler equipment to carry the load as a result of increased capacity, thus allowing the stokers to pay for themselves through the elimination of capital investment in new boilers.

The exceptional advantages of stoker firing are told in a non-technical way in an interesting book, "Coal—The Basic Fuel." Have you read it?



Why your fuel should be coal and how to burn it economically is told in this book.

Stoker Manufacturers Association

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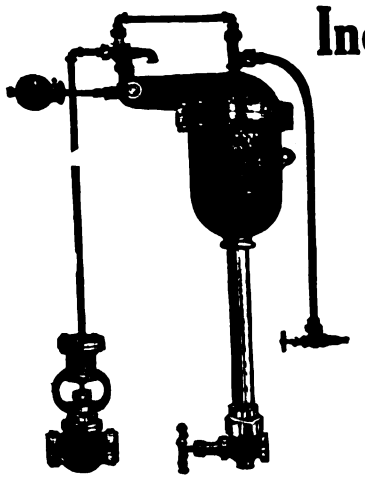
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There's a *Tycos* or *Taylor* Temperature Instrument for every purpose

Greater Fuel Economy Increased Boiler Capacity



ALL this and more with the VIGILANT Feed Water Regulator.

The Vigilant assures a steady water level at all loads—it regulates the flow of feed water—it responds automatically to every requirement.

And furthermore—the Vigilant has no complicated parts to get out of order—is absolutely dependable and reliable at all times, and protects against boiler explosions.

VIGILANT Feed Water Regulator

The premier regulator in the field. It has been giving steady reliable service for 25 years. The Vigilant is a good investment for you.

Write for the catalog today.

The Chaplin Fulton Mfg. Co.,

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For more than 42 years we have specialized in making to order *Stampings* and *Pressed Metal parts* in steel, brass, aluminum, copper, monel and zinc. We employ 1,200 workers who turn out more than 100,000 finished parts daily.

G.P.&F. SERVICE
"KNOWING HOW SINCE '81"

G. P. & F. Service means that we can ship any number of such parts promptly to your factory ready to be assembled at a lower cost than you can produce them yourself.

No matter how difficult or intricate your designs may be we guarantee to execute them to your complete satisfaction and make the parts to your order in any desired quantity.

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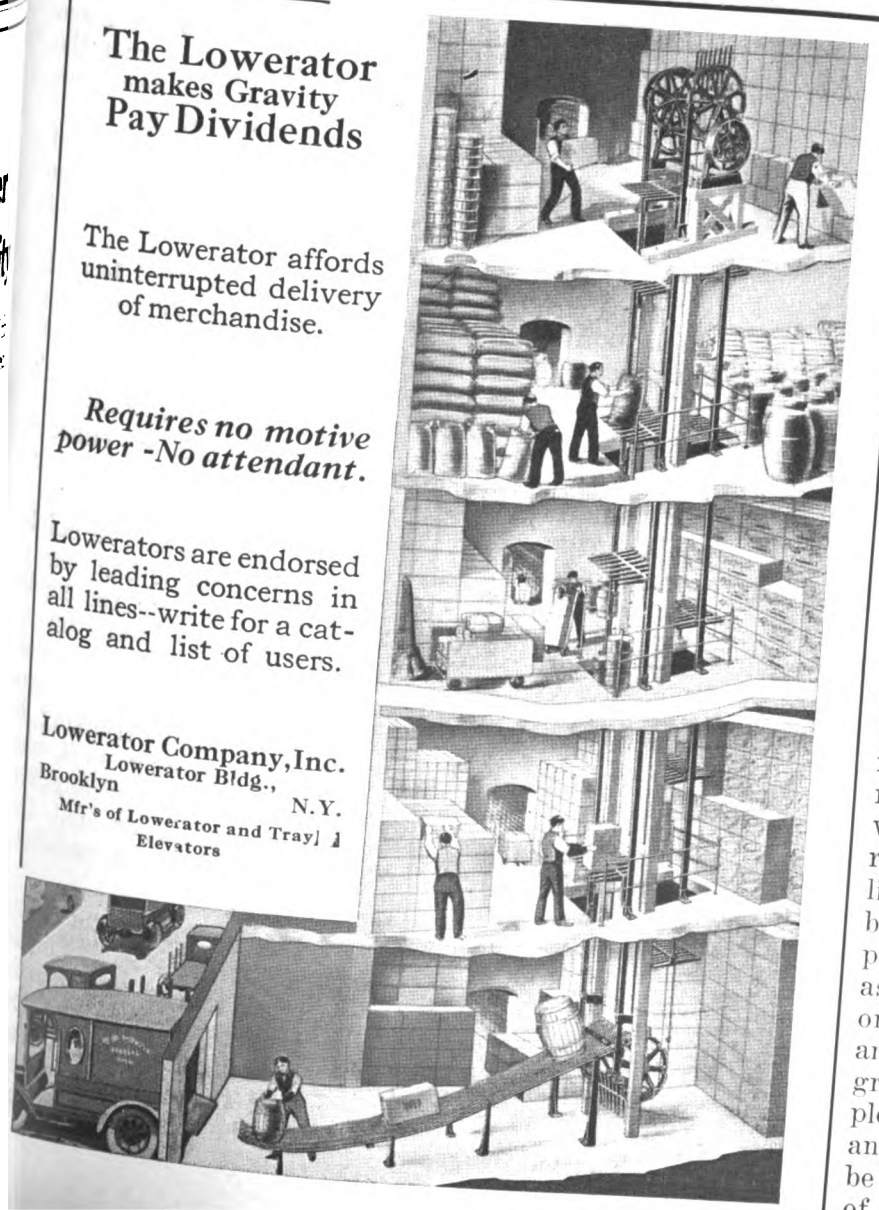
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Lowerators are endorsed by leading concerns in all lines--write for a catalog and list of users.

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(*Continued from page 55*)

24. In one of these installations, the complete train was only 30 feet in length and maintained an average speed of 700 feet per minute. This equipment, with one man, performed the work that formerly required several teams and men. The trolleys permit each sling load to be kept separate and in this way the telpher's pulling capacity is used to advantage and the volume handled per trip is materially increased.

Many adaptations of the telpher-monorail system have been made to handle loose materials with grab buckets, magnets, etc. Some installations of this character are shown in figures 21, 22, 23, 25, 26, 27, 28 and 33. The installation of an overhead monorail system may entirely supersede the use of manual labor or of trucking material by teams or by other forms of transportation. The ease with which it is possible to maintain overhead trackage in many otherwise inaccessible places such as over ravines, rivers and rough country where it would be impossible to establish any of the other means of transportation gives to the monorail system many advantages, and has led to their extensive use for outdoor work, and to transport materials for considerable distances.

The heavier types are now used chiefly on such outdoor work as lumber yards, coal piles, coal mines, etc., but have also been used successfully inside industrial plants such as power houses, warehouses and mills, and it can be said that they may be used wherever the need is great enough, and where the necessary trackage can be installed.

Because a hoisting unit is required in a monorail system, it is easy to equip the hoisting unit with either a plain hook for handling slings of materials, or they can be equipped with other hoisting accessories, such as a magnet for handling metals, automatic grab bucket to handle fuel in power plants, or for operations such as handling gravel, sand, etc., or they may be equipped with any of the various types of grab hooks, clamps, and grapples, etc., where odd shaped and assorted materials are to be handled. Almost any type of container can be used with

Has No Weights or Levers To Tamper With

There is no danger of the Sarco Temperature Regulator being thrown out of calibration, for it has no weights, levers or other parts to meddle with. Its calibration can be changed only by means of a key, which is removable and can be kept by the proper authority.

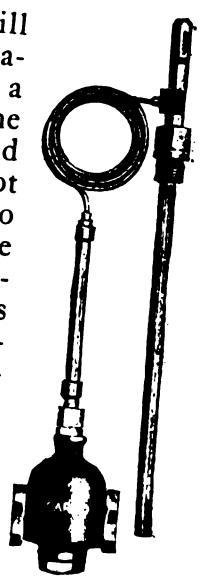
A special safety device prevents over-temperature from straining the instrument.

Only enough steam is supplied for the job, by its gentle throttling action—instead of supplying a large quantity and then shutting it off entirely. No other self-contained instrument has such a fine control as the

SARCO
Temperature Regulator

Its powerful hydraulic pressure enables the Sarco to cut through any scale that may get into it, thus preventing the valve from becoming stopped up.

The Sarco will operate in locations where a regulator of the volatile liquid type would not operate, due to the temperature of the room being almost as high as the temperature it is desired to control.



Other equally important advantages of the Sarco are explained in our interesting Booklet R-78. Write for a copy and information about our free trial offer.

SARCO CO., INC.
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this equipment for transporting materials about a shop or in a warehouse.

The monorail system has many advantages over any other form of conveying equipment, the principal ones, being:

(a) Considerable speed may be obtained with telphers, inasmuch as they travel on rails which are above the ordinary road or plant trucking. This speed may be as high as ten miles per hour. This is a distinct advantage when the distance between buildings is great. For example, in the Hood Rubber Company in Massachusetts, there is a set of monorail tracks which cross a part of the plant property, the railroad track of the Boston & Maine Railroad, and the property of another company, before it reaches its destination.

(b) The monorail system cannot be blocked by traffic in the roadway or by congestion in the aisles of the manufacturing building. It passes over all obstructions of this kind. The only way it can be obstructed is when another telpher or trolley is on the same line, and has to be stopped for some reason or other. In the case of the industrial truck which travels on the ground, if there should be a traffic congestion, or if the roadway should cross a railroad track, there would be times when the truck would be held up for a considerable length of time, due to congestion on the roadway or switching on the railroad. The monorail track in this case would be high above the railroad track and the telpher could cross independently of it.

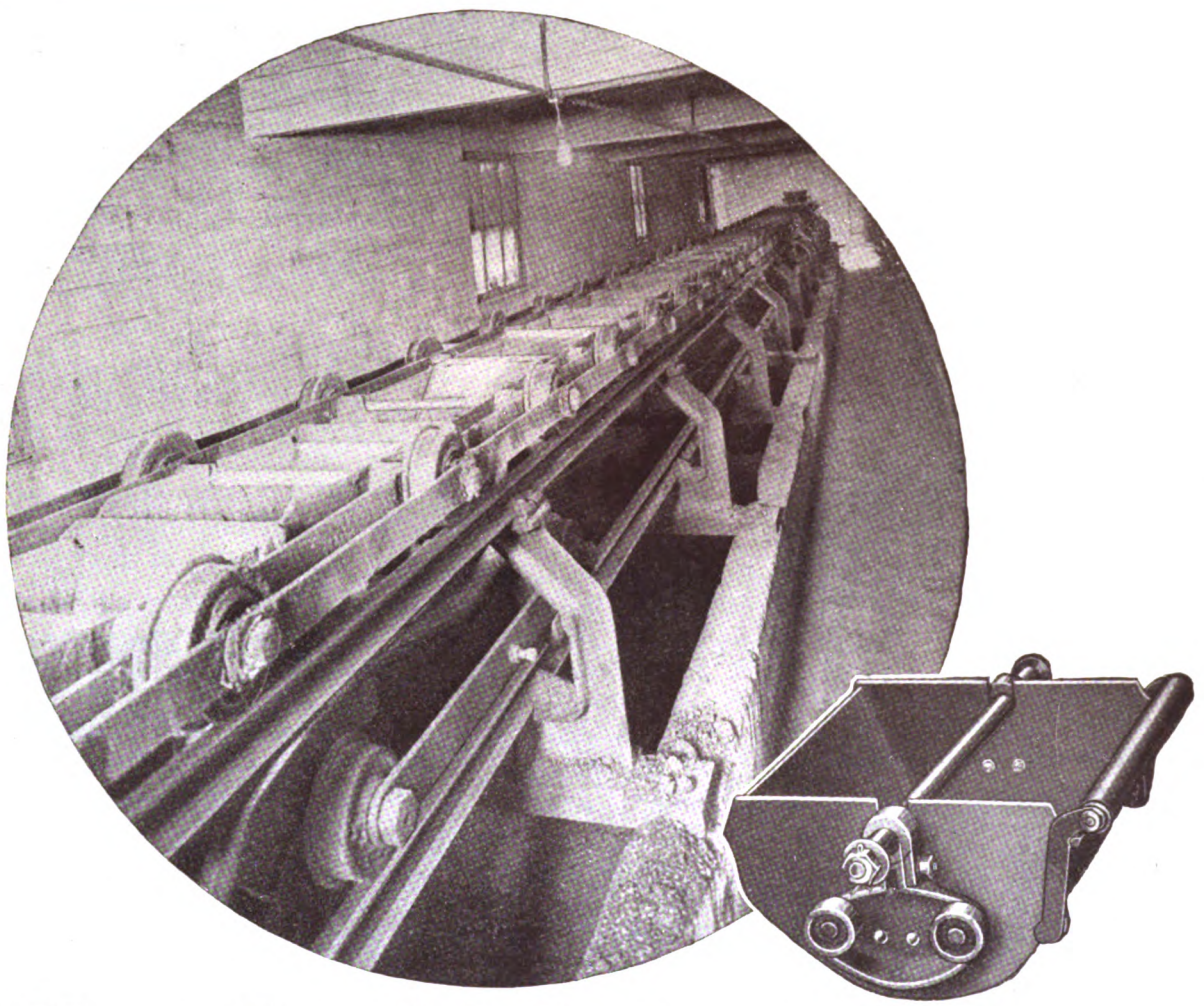
(c) With a monorail system of transportation, there is no loss of floor space for aisles. The aisles may be made only wide enough for walkways as the material is carried overhead. This enable machinery to be kept closer together, and a greater portion of the floor space made available. In the case of electric trucks or tractor trailers, the aisles have to be made wide enough so that the equipment may pass each other at any point.

(d) The monorail system of transportation can operate directly over in back of machinery.

All equipment that has advantages, generally has some disadvantages, and the monorail system of transportation is no exception to this rule.

(a) The rail and its support are somewhat costly, particularly in the heavy duty installations, and the building has to be sufficiently strong to hold the loads which are imposed on it. This advantage will also occur to a certain extent where heavy trucking is done, inasmuch as it may be necessary to strengthen floors in order that the loaded truck may be safely carried.

(b) This system of conveying is not as flexible as industrial trucks and tractor trailers, due to the fact that it cannot leave its rail and travel into any part of the plant, but is con-



If You Could See

THE Perkins Pivoted Bucket Carrier At Work—discharging a continuous stream of coal on the upper run and ashes on the lower run of conveyor—at a tremendous saving of man power—

YOU would clearly understand the great preference for this ideal, economical conveyor. Your first impression will be quickly confirmed when you see how perfectly this bucket carrier works in the boiler room.

The Perkins Pivoted Bucket Carrier handles both coal and ashes with low operating and maintenance charges. It does the work mechanically releasing labor help for more profitable work.

Sturdily built and mechanically correct in design it insures years of reliable and dependable service. This is demonstrated by the number of Webster installations successfully operating in power plants today.

Our trained staff of engineers is at your service and will furnish particulars of this improved bucket carrier upon word from you.

THE WEBSTER MFG. COMPANY

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ed to tracks. This disantage is not as serious it may seem, and it is te possible that in case amount of traffic to be en from any point is ge enough, it would pay build a monorail track hat point.

order for the monorail tem to leave the build-, and cross open spaces, s necessary for special rhead structure to be lt. This is somewhat pensive, but it is not as pensive as a concrete or halt road which would necessary for various cking equipment. Also monorail can follow an line, and is not subject conditions which would ke the other equipment ve to take a longer ite.

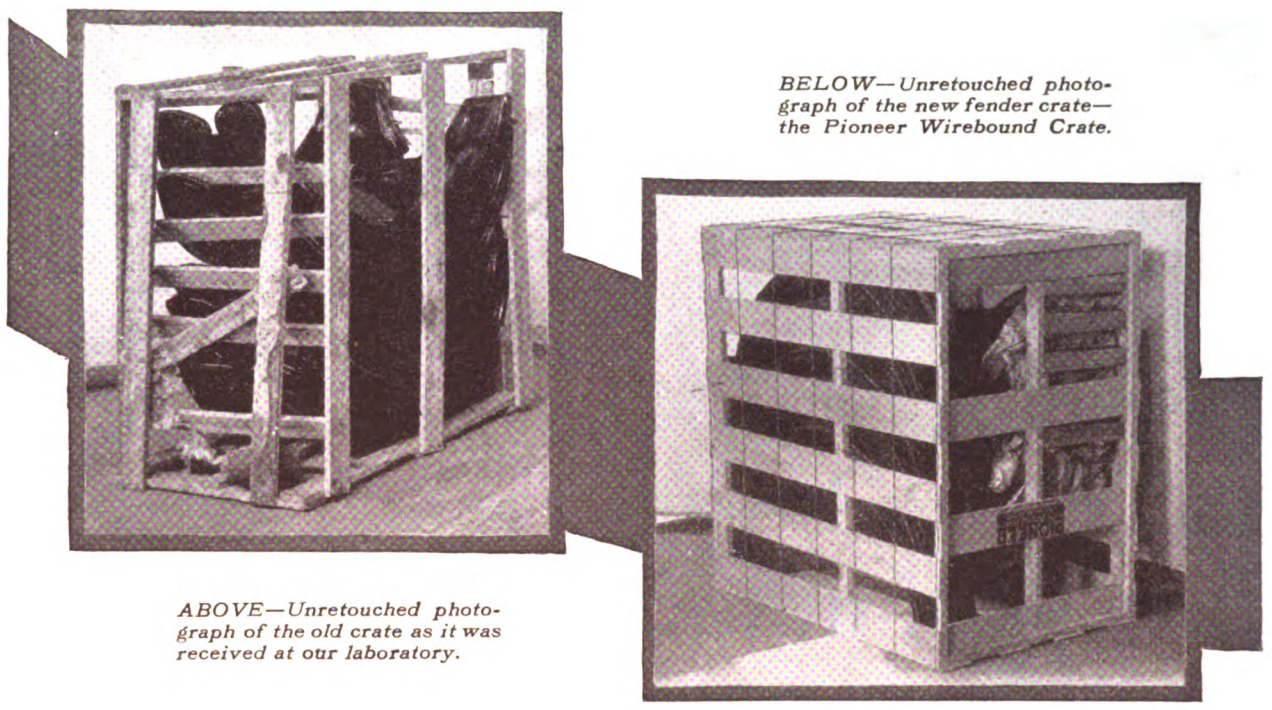
oking at any system of ortation, it has been isly mentioned that all ts should be taken into eration. That is to say, bination of two systems ally applied. It might l without fear of contra-, that no one form of ving can solve economi-ll conditions of handling ials which may be met n any particular manu-ing establishment. For ason, it is best to consid-e monorail or overhead ng system and to be fa-with its application and ation. As previously d out, it would be impos-for any other equipment rform some of the opera-shown in the accompany-lustrations, and there is ubt but that the installa-of this equipment is sav-oney and operating effi-y in the installations men-d.

terials handling has now lened its field to such an t that executives should of all the equipment that be considered under this ing, and should not over-the possible application is equipment to many of eemingly impossible mate-handling problems.

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evelopments this month reflected the irregularity he general domestic busi-situation, divergences be-en the trends in differ-industries being especially marked. But, despite this condition as well as the fact that no great increase in the volume of production and trade is in immediate prospect, prevailing conditions justify a moderately optimistic outlook for domestic business as a whole. As was pointed out in a recent issue of this Survey, the present scale of business activity is high, as compared with any but peak standards. A resumption of the abnormal production and rapidly rising commodity prices which were the outstanding features of the spring boom is not a prerequisite of continued prosperity.

Financial conditions remain highly favorable. The banks have met the peak of seasonal credit demand with ease. Any rise in money rates of a magnitude sufficient to constitute a restraining influence is highly improbable. Failures have been surprisingly few. The number of insolvencies reported to Bradstreet's for September was the lowest monthly total in nearly three years.—*The Guaranty Survey.*



BELOW—Unretouched photograph of the new fender crate—the Pioneer Wirebound Crate.

ABOVE—Unretouched photograph of the old crate as it was received at our laboratory.

How an Automobile Manufacturer Reduced His Shipping Expense

HERE is a good illustration of what you may accomplish by analyzing more closely your packing and crating costs.

Note the difference in the two crates shown above.

The Pioneer Wirebound Crate gives ample protection to the fenders. The old crate weighed 62 pounds. The Pioneer weighs but 38 pounds—saving 24 pounds excess weight.

In addition, the Pioneer Crate can be assembled in a couple of minutes—saving a great deal of time and labor. The method of interior packing is different. The new method is quicker and easier—and the fenders carry better.

To uncrate, simply cut the wires at the top and the front of the Pioneer opens up. The fenders are easily and quickly lifted out. The crate can be re-used.

This is a typical example of what General Box Engineers are accomplishing for shippers every day. If you can use Pioneer Wirebound Boxes or Crates, it will pay you—and your customers. If you cannot, we will tell you so and may be able to help you with other suggestions. We make all types of wood boxes and crates.

It will not obligate you in any way to have a General Box Engineer call on you. This service is free. A booklet, "General Box Service", will be sent you promptly on your request.

GENERAL BOX COMPANY

508 N. Dearborn Street, Chicago, Illinois

SIXTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

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"The Straight Line"

By L. B. Gough

Employment Manager, Magnolia Petroleum Co.

A STRAIGHT line is the shortest distance between two points; something we all know, but if more of us learned to *think* it we would save a great deal of lost motion. This axiom pre-supposes two essential points: the starting point and the objective you wish to reach; the desire to accomplish something, to become proficient at that task you are now engaged in.

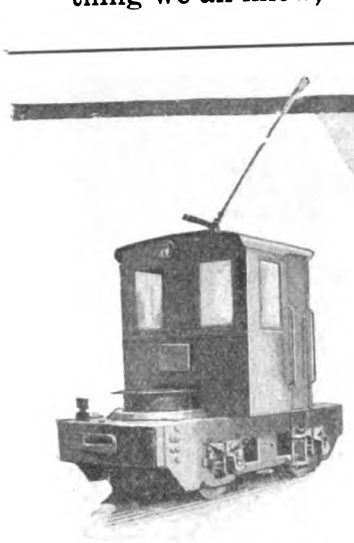
No man is thrown out of permanent employment with a company for his over-production. Some other man's service might be discontinued because of the first man speeding up in production, which naturally raises the question, is the man that's going to be you, or the other fellow, and why? If we and our industries are to prosper, we must entirely eliminate the idea of getting something for nothing; we must produce something in return for which we are paid.

It is true that the greatness of any big organization, city or nation is not measured by the number of square miles it contains, but by the number of square people it contains. Honesty, efficiency, courtesy and service are four of the main-springs of a successful business, and with these attributes, no business is busted while there is a smile left in the bank. If you are not working along this plan, then speed up or make way for a good man.

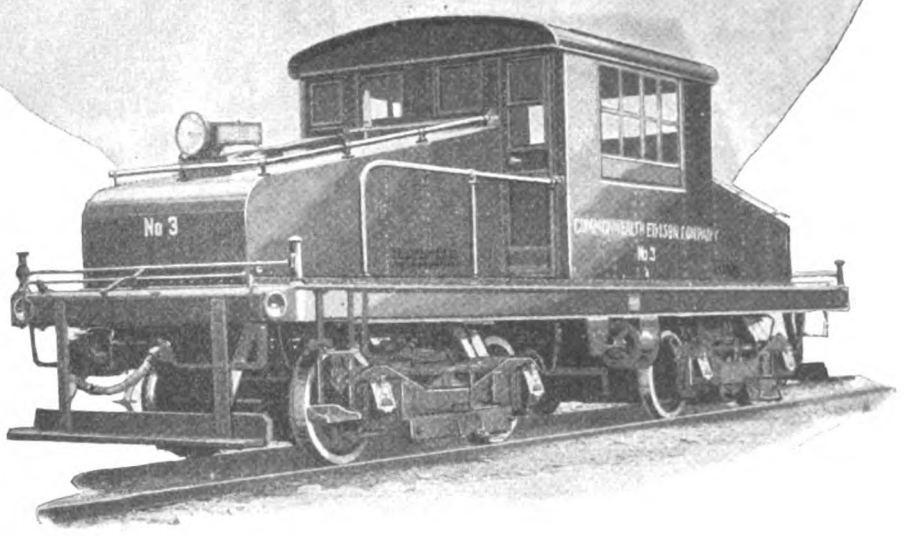
Remember, however, that what one man would do to produce might not be production for another man, as there are different conditions surrounding each particular kind of work. This simply means to accomplish something on your own job before you begin looking over the fence at the other fellow's; then, when his or a similar job is open, you may be ready for it.

The four basic principles mentioned above—honesty, efficiency, courtesy and service—lead to accomplishment. Then, if accomplishment is the big thing, the question arises as to *how* to accomplish, *how* to get a definite result. We cannot all direct; and many would not be successful if given the opportunity. No conditions are ideal. We must adjust to them and improve them when we can. Face the facts, revive the old standard of sturdy, uncompromising American honesty. Be honest with yourself, your company and your fellow workmen.

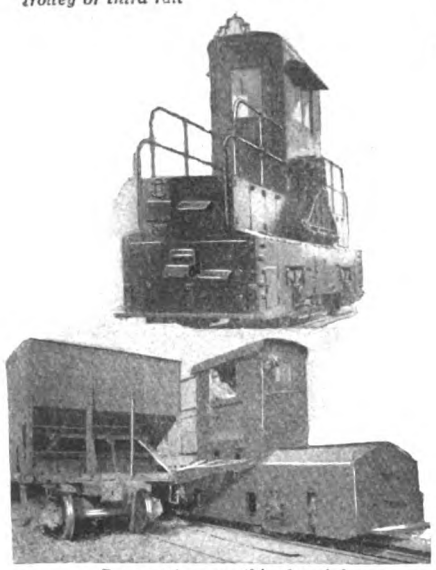
(Continued on page 62)



Light haulage locomotive for quarry work. Equipped with cable-reel where not practical to erect trolley or third rail



G-E 50-ton third rail type for heavy yard service



For spotting cars this electric locomotive is equipped with side arms operated from the cab

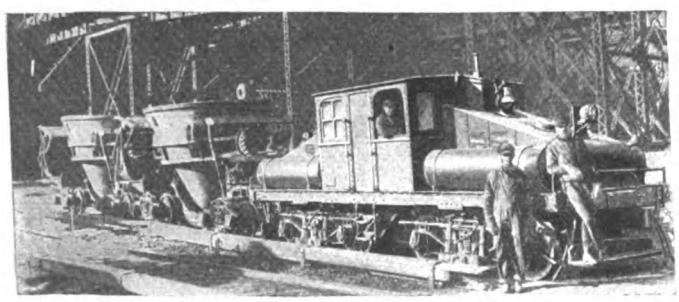
Where Trolley Locomotives Serve

Long heavy hauls—continuous peak load traffic—shifting at terminals—incoming and outgoing freight—in these and many other phases of industrial haulage, G-E Trolley Type Locomotives are proving the better way.

Here are pictured representative types of G-E Locomotives for trolley and third rail service. Locomotives designed and built by the General Electric Company cover a range of sizes and forms wide enough to include any haulage requirement of this nature—and they incorporate principles of construction which are the result of many years of experience in this class of work.

When you buy haulage service, consider what our thirty years' experience in building complete electric locomotives can produce to exactly meet your requirements.

Interesting and valuable detail of the uses of electric locomotives for industrial haulage is contained in ***Bulletin No. 44251*** which will be mailed you free upon your request. Write for it today.



Special type G-E Locomotive for hauling and operating slag pots



Special type of third rail locomotive —showing G-E ability to fit particular service requirements

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ELEVEYOR—3 Trucks in 1—Performance Lands Another Repeat Order



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The best proof of the money and labor saving features of ELEVEYOR Electric Trucks are the repeat orders after sufficient trial has been given them.

The above illustration shows the ELEVEYOR at the Continental Paper Company, Bogota, N. J. The fact that each ELEVEYOR does the duty of 3 trucks—a truck for conveying materials, a lift truck and a portable elevator for stacking—means thousands of dollars saved in the handling of materials.

And the savings effected has led to the purchase of additional ELEVEYOR Trucks just as they have done in other industrial plants.

Investigate the reasons for this.

ELEVEYOR INDUSTRIAL TRUCK CORP.
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NILES CRANES



Save time—Save labor—Save space with modern crane equipment

STONE QUARRIES with their necessarily large storage yards where very heavy weights must constantly be lifted and transported are large users of Niles Cranes.

Careful construction of details obviates any interference with perfect operation. Exposure to all sorts of severe weather conditions does not affect them.

Long life, security and low maintenance are the predominant characteristics which make Niles Crane equipment a favorite in all fields of industry.

NILES CRANES
For the Steel Mill, Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy material must be handled with speed, safety and economy.

Builders of cranes for every requirement

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Cuts the Cost of Reclaiming Coal

USED in conjunction with other equipment or used alone, the Scoop Conveyor is a mighty handy machine to have around for reclaiming or transferring coal from storage pile to boiler room.

It is ideal for loading small hand cars, electric dump trucks and similar equipment which in turn carry the coal into the boiler room. When the coal storage is not too far from the plant, two or more conveyors can be placed in tandem style, one feeding to another, and thus by feeding one machine the coal is delivered direct to the boiler room.

Well balanced construction permits extreme portability so that the machine can be easily moved about the yard.

Of course the same machine is used for unloading cars, storing coal and loading trucks or wagons. Any kind of coal, coke, ashes, sand, gravel, stone, etc., can be carried on the machine.

Thousands of users have found the Scoop Conveyor an extraordinary good investment.

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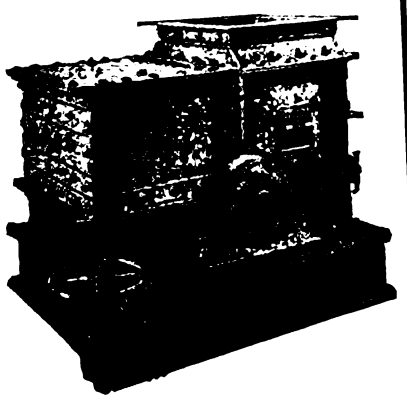
Portable Machinery Co.,
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THE SCOOP CONVEYOR

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"PENNSYLVANIA" CRUSHERS

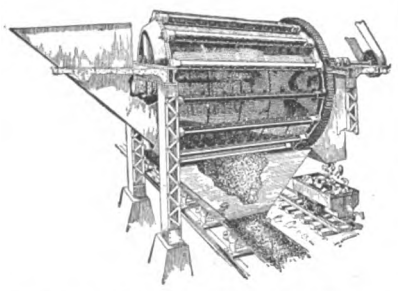


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For Coal, Lime, Limestone, Shale, etc.

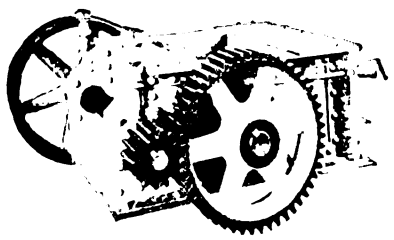
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BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY

Stephen Girard Bldg., Philadelphia.
New York Pittsburgh Chicago

(*Continued from page 60*)

Efficiency has common sense as its basis. Without common sense there can be no efficiency. It is the basis that permits the executive to disregard fixed ideas and adopt methods without regard to prejudice or precedent. You cannot define it, but you must have it in you and about you if you are to accomplish.

If the man from the farm has come to the industrial plant and finds that he is unfitted and not adaptable to the conditions, then common sense should send him back to the farm; but if, with his energy and work, he crowds one of the "regulars" out of his job, then common sense should either speed the other fellow up or send *him* to the farm. Today is the day of the specialist. It matters not what branch of an industry you are in, there are some hundred different jobs to master which require application, study and work, so it is up to you to learn all there is to know about your particular job; then you will be in position to learn something about the other branches of the company for which you work.

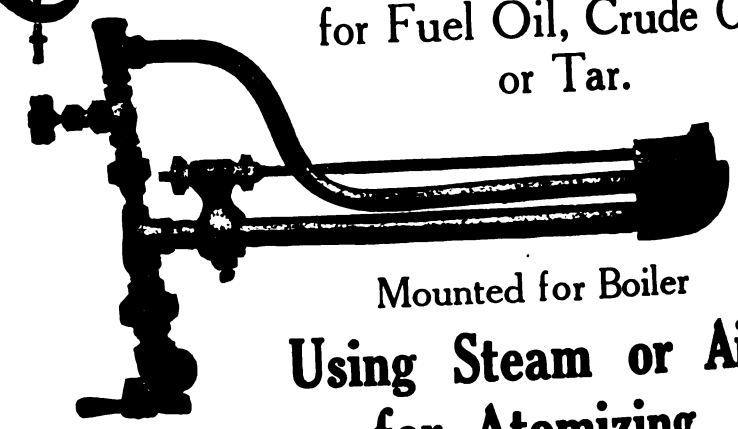
The next step to accomplishment is courtesy. It is that something that gives a man a new lease on life, something that cannot be bought and sold, but it is of great value. Be courteous to the new man, give him a chance to learn the things that you were taught. Give him counsel and advice, let him have the benefit of your knowledge and experience.

The fourth basic principle in accomplishment is *service*. It seems to be a law of human nature that we follow the line of least resistance. Without the will to do, there is no service. The success of a whole industry depends not alone upon its wealth, or its men, or its products, but upon the spirit of service, which is the energizing power in any organization. It represents the men who do things.

If you have builded on the theory of getting something for nothing, then your just reward would be nothing. Personality in a man is not what he *intends* or *pretends* to do, but what he *is*. It is the outward expression of the inward self. It is the man himself. On this basis is the reward for faithful services given.

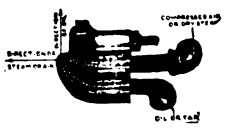
CALOREX Burners

for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



CALOREX Unmounted

Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

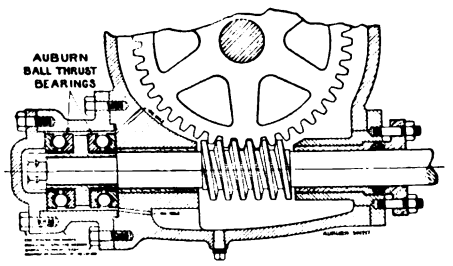
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W. N. BEST Corporation

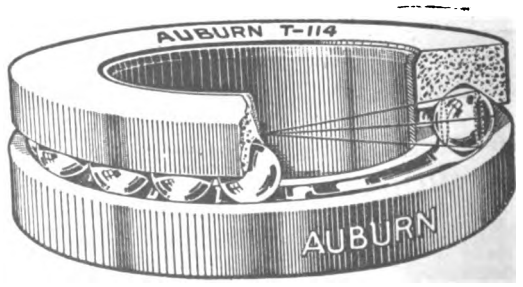
11 Broadway ENGINEERS IN CALORIC NEW YORK

There is nothing better than the Best

WORM DRIVES operate more smoothly with AUBURN THRUSTS



The use of Auburn Ball Thrust Bearings with their minimum of wear and constant thickness insures the least amount of backlash, and avoids jerky starting and stopping of the worm drive. Auburn Thrusts thus tend to prolong the life of both worm and gear and make a smoother operating machine over a long period of time.



Send details of your problem and ask for data sheets.

STEEL, BRASS AND BRONZE BALLS

AUBURN BALL BEARING CO.

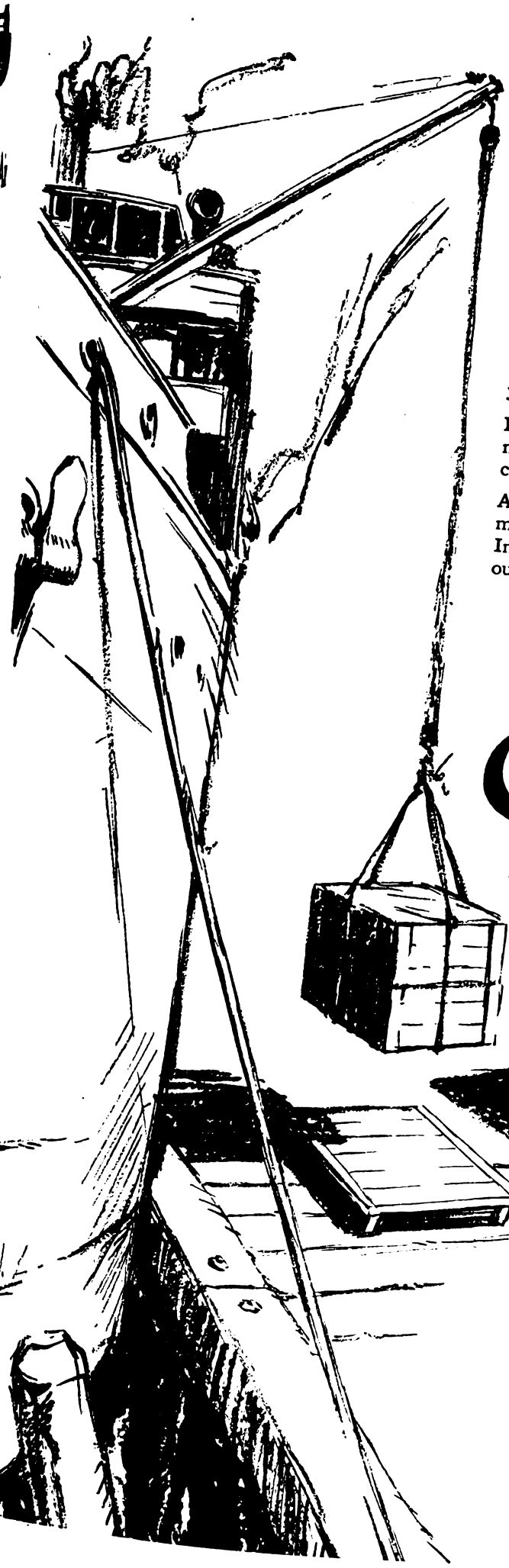
24 Elizabeth St., Trade Mark Rochester, N. Y.

Established 1893

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"We find the Stuebing to be the cheapest and most efficient for our service"

President, Bush Terminal Co., New York City



Stuebings cannot hope to serve *all* Industry, much as Industry needs what Stuebings so adequately—yes, and so *exclusively*—provide.

There will always be those who underestimate their needs and content themselves with but a share of what could be their portion.

But wherever the need is fully realized—wherever the *full measure* of lift truck economy and efficiency is insisted upon—*there you will find Stuebings!*

For the directing heads of plants both large and small have discovered that lift truck savings are *real* only when upkeep costs are *low*.

And they have stopped the leak in their lift truck savings by standardizing on Stuebings—the only truck they could find built to meet their needs.

Take Bush Terminal in New York, for instance. For 2 years the repairs on 51 Stuebings in constant service amounted to only $65—*a trifle over 5c a month for upkeep!*

Try to duplicate that record with any truck other than a Stuebing and you'll realize that Stuebings *are* different from any other lift truck made.

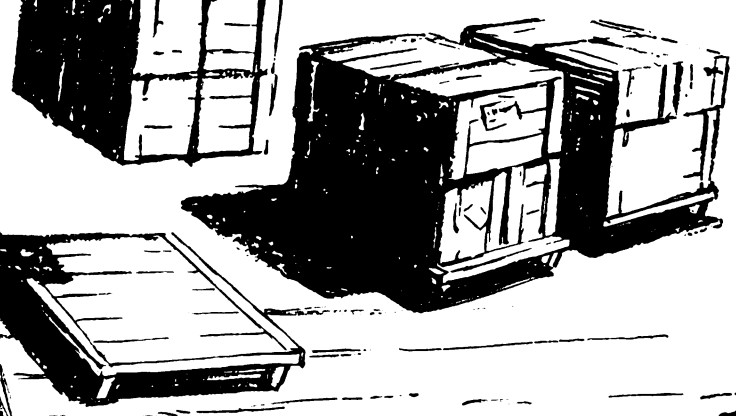
Because of the character of its design and the unapproached quality of its material and workmanship, the Stuebing is the *one* lift truck that is in a class with *fine machinery*.

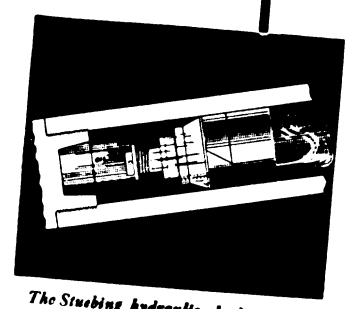
And the fact that Stuebings serve in greatest number where costs are most closely scrutinized is a unique tribute to the foresight that anticipated Industry's *real* needs and provided a truck to meet them *fully*. Send for our new catalog.

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LIFT TRUCK SYSTEMS

NO OTHER LIFT TRUCK IS BUILT LIKE A STUEBING





The Stuebing hydraulic check is accurately machined from one-piece seamless steel tubing and fitted with oil-tight piston containing a split ring



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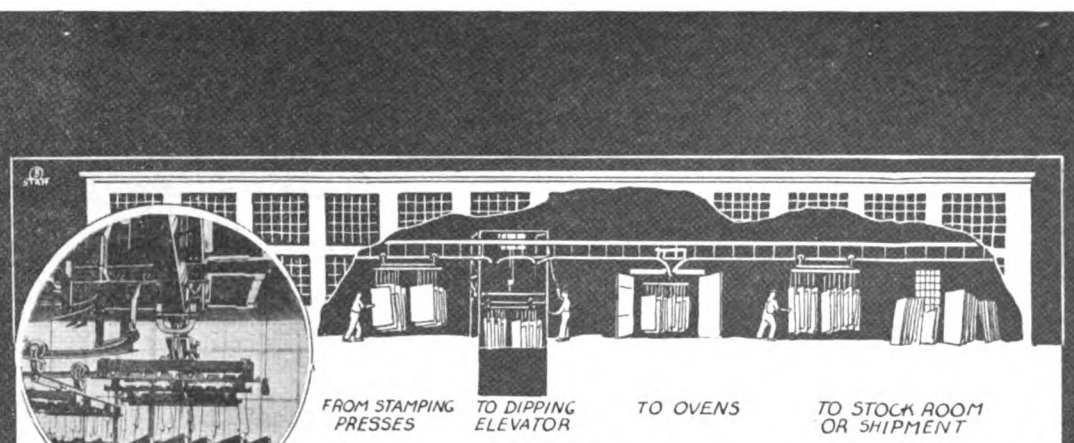
The Industrial "Daily Dozen"

(*Continued from page* 13)

soon this feeling will disappear. If a concrete floor starts to dust or wear in spots, it can be treated with a hardener or paint. The best treatment differs for different conditions of service. A wood block floor which becomes badly worn can be torn up and patched fairly easily. When tongued and grooved hardwood floors become worn they are rather hard to patch if the boards are long and run under machines which are in use. It is, of course, possible to cut down with a chisel on a certain line and fit the new flooring into the old. If only the trucking aisle is worn it can be easily fixed by laying a new floor directly on top of the old one and beveling the edges where it meets the old floor. It is necessary to wedge shims on thin strips of wood at badly worn spots under the new floor as it is laid, so that it will be solid. When composition floors become worn they can usually be patched but if a waterproof job is required it usually will be found best to put on a new coating.

Walls and ceilings require brushing or wiping down occasionally to remove the dust. The length of time between cleanings naturally depends on the class of work being done in each particular room. Belts running at high speed throw dust onto ceilings and walls and this darkens the room. With a gloss paint the time between paintings can be increased but it should be borne in mind that white paint saves money in lighting bills. Where the walls are apt to be spotted by dirty hands it is well to paint them a dark green up to about five feet from the floor. This is called a "dado." Mostly all factories can use a white gloss paint and as this stays clean longer than flat paint, it should always be used unless the room in question is exceptionally bright. A medium gloss finish or eggshell finish is sometimes used as a compromise between gloss and flat. Concrete or brick walls at entrances to doorways and elevators should be protected by a steel angle iron corner to keep trucks from knocking off the corners of the wall.

It is a good policy to have a regular schedule of window cleaning and to live up to it. During cold weather it is usual to have cleanings much further apart but with the various cleaning compounds now available windows can be cleaned during cold weather. In order to clean the outside of windows where steel sash is used, a staging which can be hooked onto the sash is necessary. This can be about three feet wide and be light enough to be moved from one sash to the next. A wire or netting protection railing should be provided around the staging so the operator can't fall off backwards. Wooden sash which slide up and down are easily cleaned without equipment. Cracked or broken windows should be replaced at once as rain might damage work left near-by. If there are concrete buildings with plain glass it is



Re-handling of material in the various processes of Japanning is entirely eliminated, a carrier loaded at the stamping presses need not be re-handled until it is unloaded at the finished stock racks.

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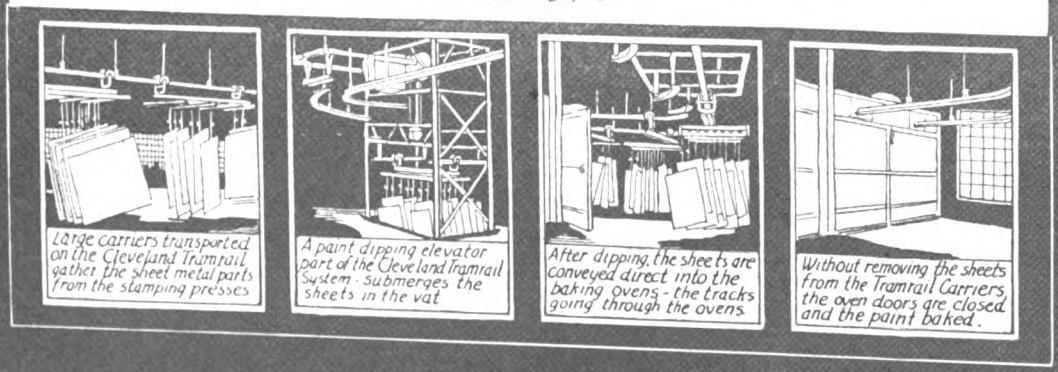
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good idea to replace each ken pane with wire glass. us, in several years, there l be a large percentage of e glass in place and an adional investment to complete job will lower the insurce rates. With the prevailg high prices of coal, all inging sash should be inected to see that they are ht when they are shut. Venation is necessary but in zero eather tight sash are necesry if the building is to be pt comfortable. Long chains ich will allow adjustment to small opening are needed for ld weather. Sash should be ne over every Fall and reittied so that storms during e winter will not damage ork or goods left on benches ong the wall. Continual amming of lower steel sash ill eventually loosen the ame from the concrete sill. can be grouted in with a in Portland cement or morr patched with a plastic roofg cement. This grouting hould be done in the Fall to eep out melting snow.

Janitors are necessary if roper care is to be given to oilet rooms, although one man requently takes care of sevral. Toilets and washbowls hould be thoroughly cleaned t least once a day and if posible, twice a day. If the janitor akes care of several rooms, a steel locker with a small stock of supplies should be located in or near each toilet room. Metal partitions with an open space of a foot or so from the floor are the most sanitary kind to have between toilets as no vermin can live in them. Concrete or other waterproof floors with a drain in them are ideal for toilet rooms as they can be washed down with a hose. With tile or other waterproof walls, the hose can be used on them also. Some kind of a disinfectant is absolutely necessary if a toilet room is to be kept sanitary. At frequent intervals all partitions, walls and equipment should be washed with a disinfectant solution to kill any vermin or bacteria. The management should let employees know that their health is being taken care of and their assistance in this great work should be cultivated. Soap is usually furnished in office toilet rooms only, because the men in the shop frequently need strong soap to get off the dirt. Cake soap is not as sanitary as liquid or powdered soap. There are many containers available for liquid and powdered soap. All toilet rooms should be well ventilated. If the natural ventilation is not enough, a small motor driven exhaust fan can be installed in a window. A good sized vent pipe leading to the roof will sometimes do the trick if there is a ventilater top on it so there cannot be any back draft.

Wooden partitions and stock racks require repairs when they become damaged by trucks or otherwise. Heavy loads of stock on racks will tend to make them lean to one end or the other and they should be well braced to prevent this, as they may collapse if they get too far out of plumb. Try a plumb bob on them occasionally. Steel stock racks should be kept plumb and have all bolts tightened from time to time.

If all power and light wiring is run in conduit it cannot be damaged but if old wiring is exposed it should be carefully



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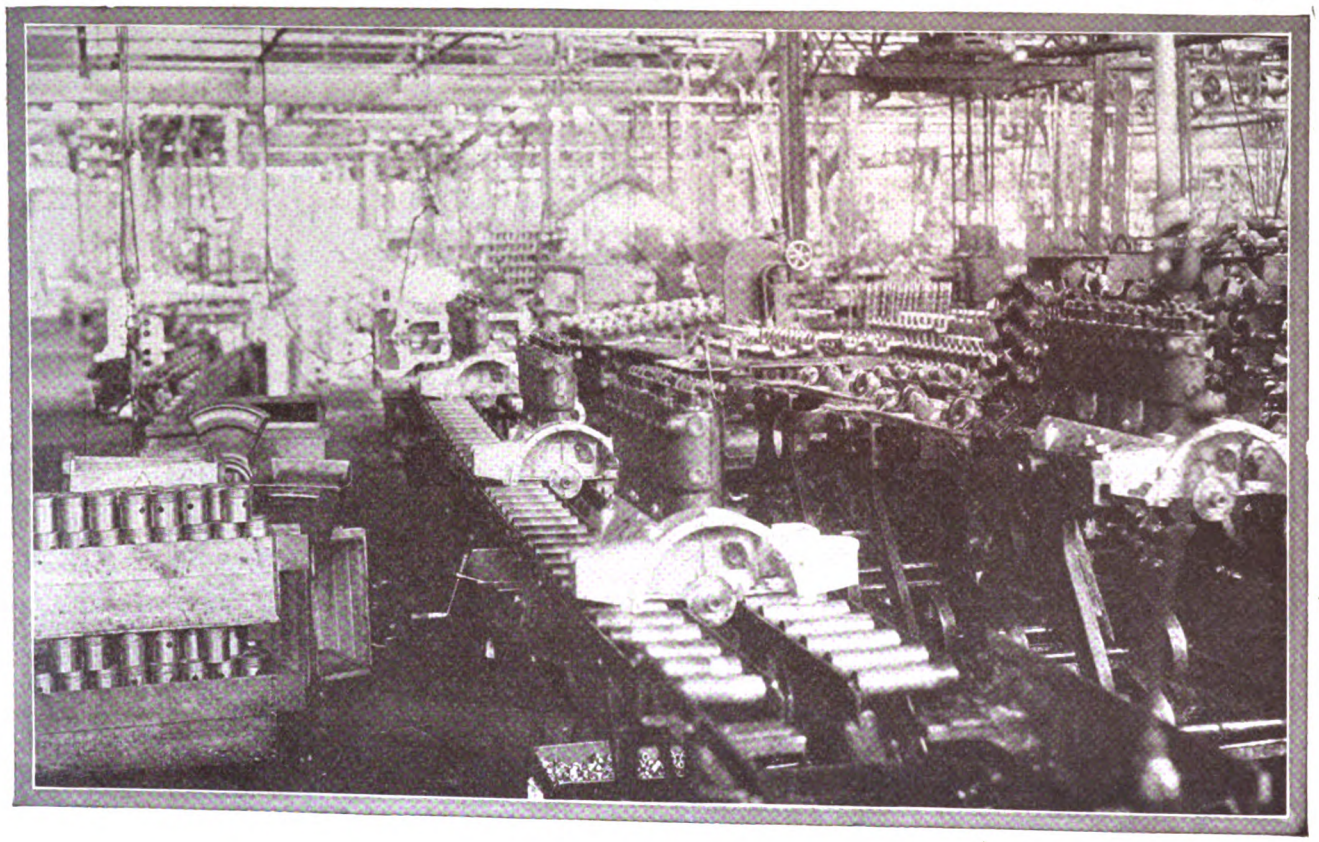
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watched to see that the covering is not rubbed off. General lighting units as well as individual lights should be cleaned at least every three months, and where they are exposed to excessive dust, every month. Shades should be washed at the same time. The small shades used on individual lights are not very expensive and a good way to do this work is to buy enough spare shades for one room and take off the dirty and paint chipped shades, replacing them with the new spare shades. Then the ones just taken off can be cleaned and painted and used in the next room. If your electric bulbs disappear, put on locked guards over the shades, or put on locked sockets. The cost will be repaid very soon. Fuses are an expensive item if they blow frequently. Where fuse bills are high have the electrician investigate and report on the advisability of using renewable fuses. Some circuits require circuit breakers but the head electrician should be convinced that they are necessary and advisable.

Valves on steam and hot water heating systems should be packed in the Fall as the old packing will be dried out and may cause a leak. Sagging steam pipes should be lined up so condensation won't pocket in them and cause water hammer. The valves at the return end of a two-pipe steam heating system should be in good working order. Dust on heating pipes smells bad when the heat is turned on, and it acts as an insulator too. Two good reasons why it should be brushed or wiped off. As steam mains expand when heated, expansion joints or large wide sweep bends are necessary to keep them tight. Long horizontal mains should be hung in roller hangers. The insulating covering on steam and hot water mains is very important and if it becomes loosened or broken off it should be repaired at once. The practice of painting each kind of pipe with its distinctive color is fast becoming popular as it enables the repair men to follow a pipe easily and quickly.

The importance of proper care and maintenance of sprinkler systems cannot be stressed too much. Valves which control large areas should be sealed open or shut as the case may be. The insurance companies' inspectors will watch for violations of this rule when they come around, but the safest way is to have the watchmen responsible for the way valves are set and sealed. In some locations the sprinkler heads corrode, and new ones should be put in at least every year. Sprinkler pipes should be painted at the same time as the ceilings. If the conventional color for pipes is carried out they will be painted red, although some prefer to have them white like the ceiling. Hose will rot quickly if not given care. Be sure it is dried after using it. It should be hung up in the stair tower for a day or two at least. Fire extinguishers should be refilled in accordance with insurance requirements and it should be the sweeper's or porter's job to see to it that water buckets are kept full at all times. Where oil is heated it is well to have a few buckets of sand instead of water and a soft asbestos sheet to smother

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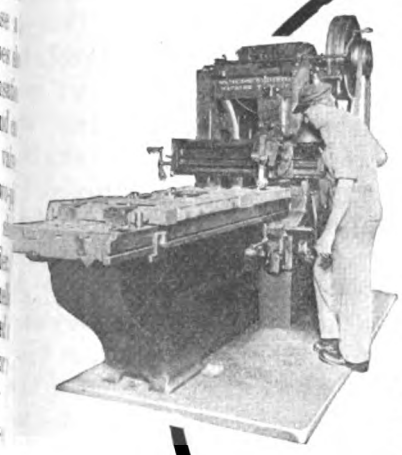
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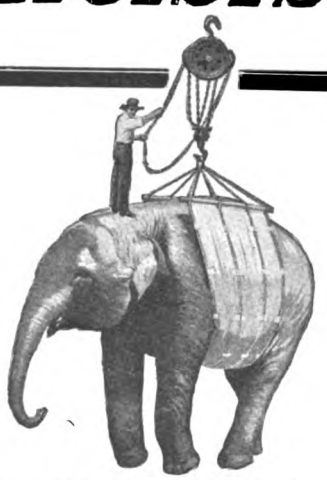
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any flame. Each winter a great deal of water damage is done by sprinkler pipes freezing and bursting. Watchmen should close any windows left open by the workmen as the watchmen make their first round. Watchmen should watch the thermometers located in various place throughout the plant and report immediately to their chief if a room gets below 40 deg. F. That is a good margin of safety above freezing. When sprinklers are located in open sheds or in monitors of buildings where the monitor windows are constantly open, they should be shut off and drained in the winter unless they are on a dry pipe system which is especially designed for places without heat. Underground pipes are hard to get at quickly, so if important pipes are carried underground from one building to another, a pipe tunnel or at least a hardwood box culvert a few feet underground should be used.

Motors and fans on ventilating equipment need oiling and cleaning to keep them running. The piping or air ducts themselves should be painted to prevent rusting. A polishing room exhaust system is the hardest kind to keep in good condition by the very nature of the work itself. Lint from the buffing wheels will catch on the slightest rough spot and soon a large part of the area of the duct is filled up. Most good systems have cleanout holes along the duct. State laws require a certain minimum suction at the hoods and as soon as this minimum is reached the system must be cleaned. It is much better, however, to clean it out on a regular schedule and have a good suction at all times. The dust can at the bottom of the dust collector should be emptied every day to insure efficient operation of the system. When paint or japan are sprayed onto the product this work is usually done in a separate room or in a specially constructed hood as this vapor is highly inflammable. When the blades of the fan get clogged with the paint or japan it is necessary to scrape off or dissolve the deposit. If a motor is directly in the path of the paint laden vapor it is usually a totally enclosed one.

Roofs should be kept clear

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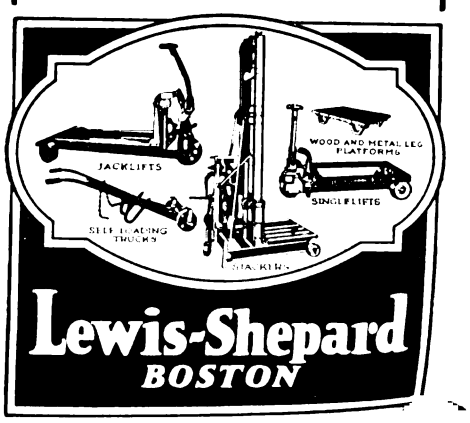
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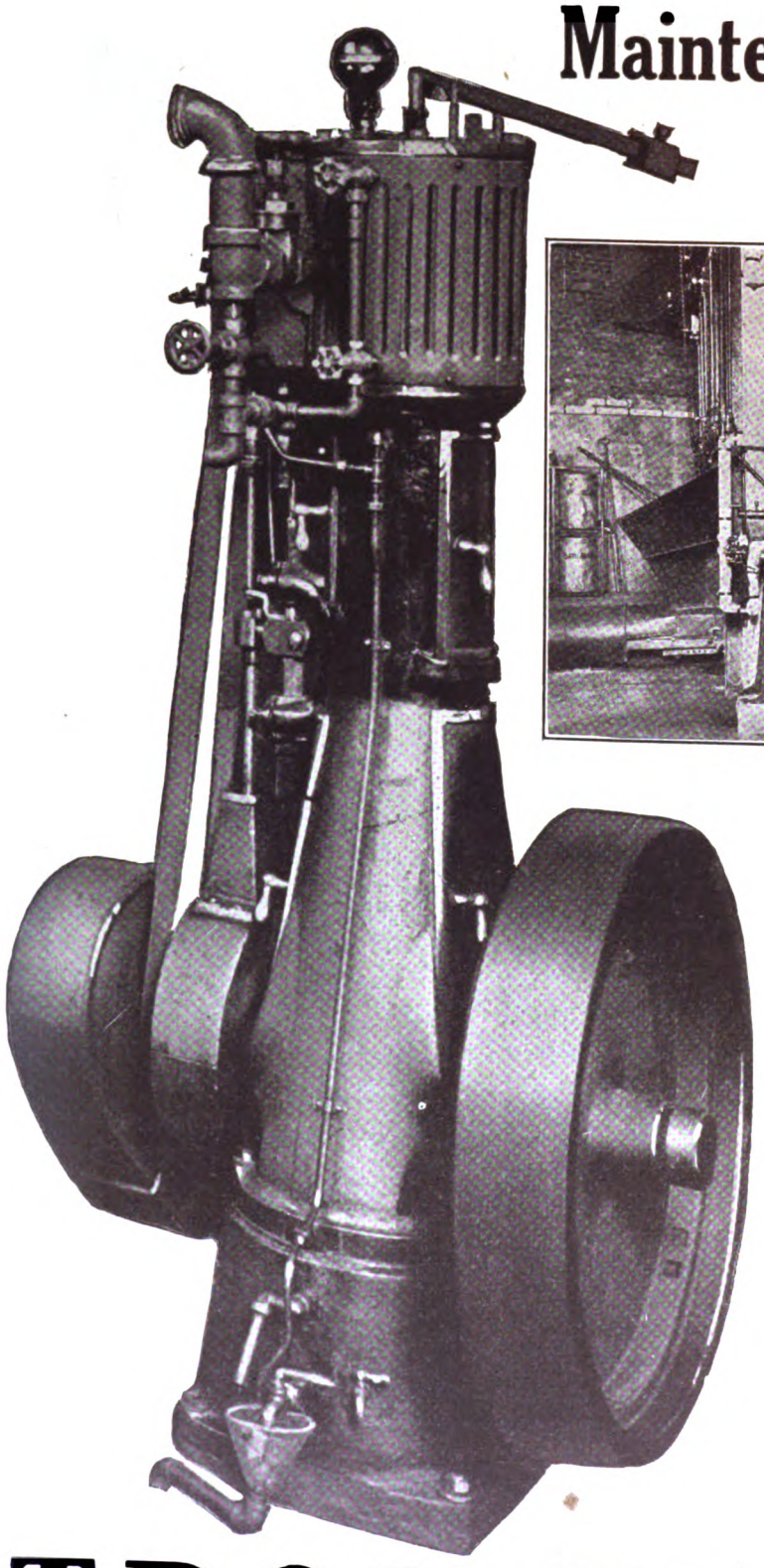


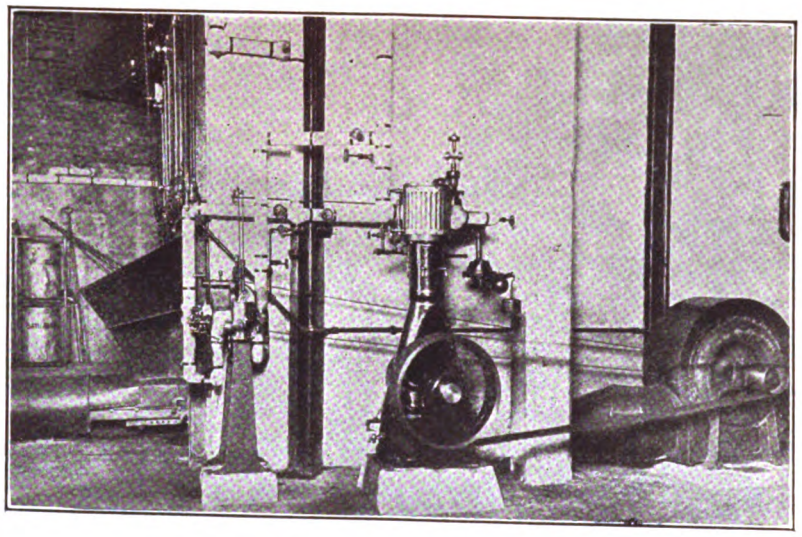
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of dirt, leaves and branches of trees. These may clog up the downspouts or leaders and cause an overflow or a leak during a storm. All roofs should be carefully inspected once a year and special attention should be paid to the area around the leaders and at the flashing. Roofs laid of many layers of roll roofing permanently cemented together and with a layer of slag or gravel on top should not require any maintenance. If they were well laid they are good for many years without attention. Tin roofs should be carefully inspected each year and any spots touched up. They should be painted all over at least every three years. Leaders on the outside of a building frequently freeze up in the winter. If this happens, a waste steam line can be turned into the leader under ground and this will keep it open. The newer types of buildings usually have leaders inside the building and of cast iron, and they last almost indefinitely. Steel tanks and their structural steel supports require painting at least every three years and it is best to inspect them each year, touching up any rusty spots. Rust will destroy quickly once it gets started and the cost of painting is saved on outdoor steel work quicker than anywhere else. The metal used for skylight frames is often galvanized iron and as this is thin it should be carefully watched and painted every year if necessary. Any cracked or broken glass can be replaced and the glass tightened up at the same time. Heavy wire glass is usually furnished for skylights and this should be protected by a heavy wire netting about a foot above the glass. Dust collectors and the suction piping leading to them are usually galvanized iron and may require painting every year but if it is not necessary to go over the whole surface, any rusty spots should be touched up.

The exterior of the buildings will require different treatments depending on the materials of construction. A concrete building can go a long while without painting if it was made of good materials and if the surface was well finished when it was built. The writer has known of comparatively new concrete buildings where the surface deteriorated in a few years. This could have been avoided by inspection of materials and workmanship at the time of construction or possibly by treating or painting the surface. Buildings on the street which are seen by thousands of people have an advertising value and should be kept in excellent condition even though part of the maintenance cost be charged to advertising. Buildings inside the factory plot, however, should not be neglected because they are not seen by outsiders but should be kept in repair as a conservation of an asset. Brick buildings laid with cement mortar should not require painting very often. In time the bricks may require painting, however. As practically all factory buildings are either concrete or brick, these are the only two which need to be considered. If brick buildings are covered with ivy the vines should be cut back from the windows each year so they will not keep out light. Steel

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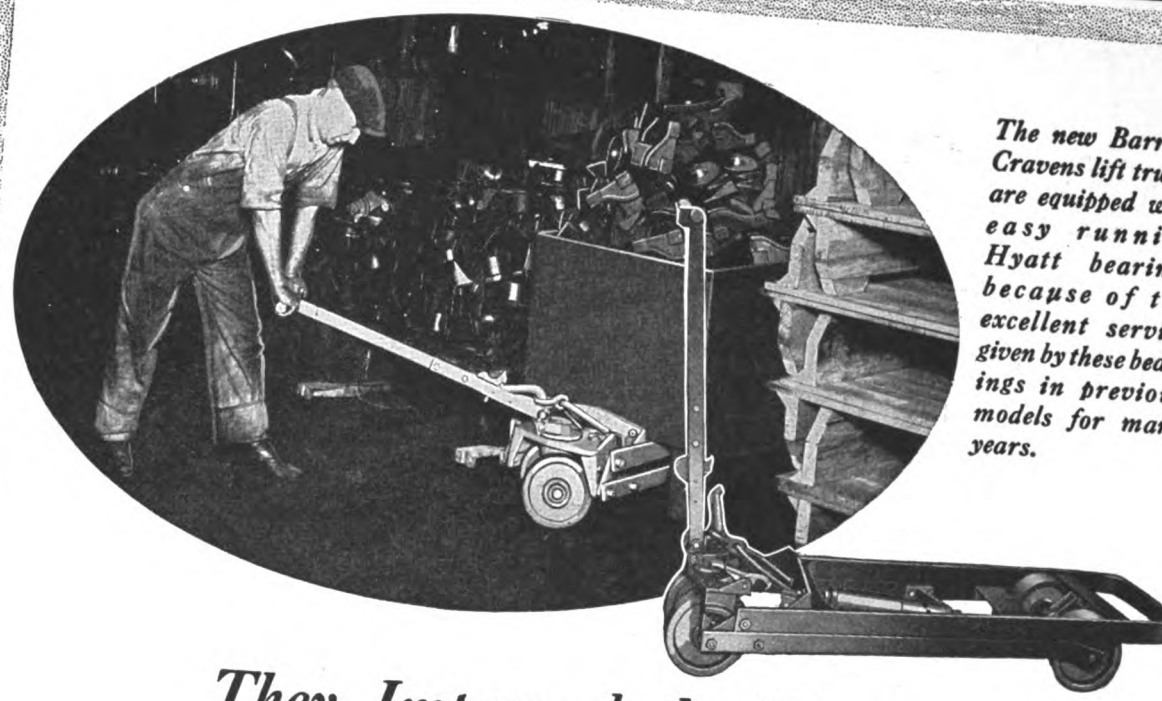
sash needs painting every three years and wooden sash requires about the same care. If wooden sash are not tight, metal weather strips will make them so. The saving in coal will pay for this in a few years. Sheds or blank walls can be spray painted and for this large surface work it is cheaper than hand work. Fire escapes are so important that they should be inspected and rusty spots touched up every year and painted all over every two years. If they have a swinging portion this should be tested frequently. Bolts holding the fire escape to the wall should be tightened up before painting and if any are loose, larger bolts should be put in or bolts put in right through the wall.

If trucking is done across the factory yard from one building to another, smooth concrete truckways or walks are necessary. If lift trucks are used there should not be any abrupt changes in grades as they will cause the load to drop. In order to keep these walks in good condition in the winter, they should be drained so that frost won't get under and heave them. In large yards the roads are frequently made of concrete. However, crushed rock, well rolled, makes a good factory yard if trucking is not severe. Holes in the crushed rock roads should be filled in as they appear in order to keep them in condition.

Maintenance is an endless job and in order to keep things in good shape, some system of inspection is necessary. If a special inspector is not available, the foremen in the different departments throughout the plant should report any matters coming under their observation. A small form for this purpose should be provided and this will enable the maintenance departments to schedule their work to take care of all regular repairs in their order.

The reaction of the European situation upon the United States is definitely reflected in the decline of our exports to Europe. For the year ending June 30, 1923, our wheat exports were 155,000,000 bushels, as compared with 208,000,000 for the previous year. In that period our exports to Germany declined from $350,495,000 to $293,132,000. Exports of copper to Germany for the same period dropped 76 million pounds, and lead exports 13 million pounds. Germany's cotton purchases declined 45 per cent. during the same period and France and England also have reduced their cotton purchases.

Any further increase of political or economic troubles in the countries of Europe is certain to be reflected in decreased buying power on their part. Even France, which is at present, apparently, the most prosperous of the European countries is building up a mountain of debt and fixed charges which constitute an ever-increasing burden upon her people and a menace to their prosperity. More than two-thirds of her budget is now required to meet the interest on her three hundred billion franc debt, and additional borrowing of fifty billion francs is planned.—*The Guaranty Survey.*



The new Barrett-Cravens lift trucks are equipped with easy running Hyatt bearings because of the excellent service given by these bearings in previous models for many years.

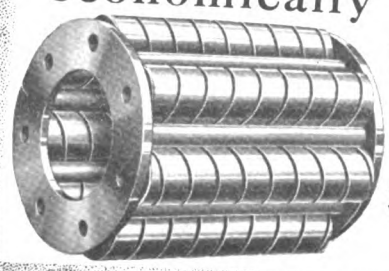
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IN REPLY REFER TO

Sept. 12, 1923

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All parts are now stored in the exact sequence of their use and unnecessary handling of our product has been eliminated. These facts contribute to the quality of workmanship.

I am sending you a photograph of our first line in operation after its installation.

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THE HAZELETT STORAGE BATTERY COMPANY
C. H. Hazelett

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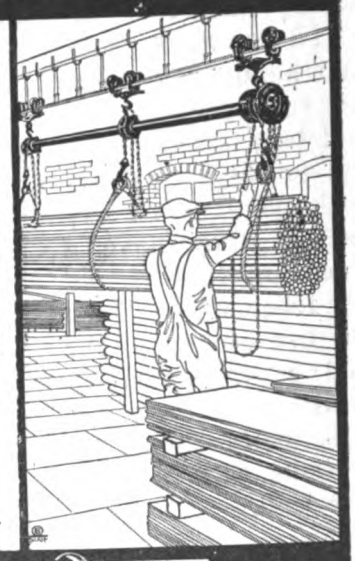
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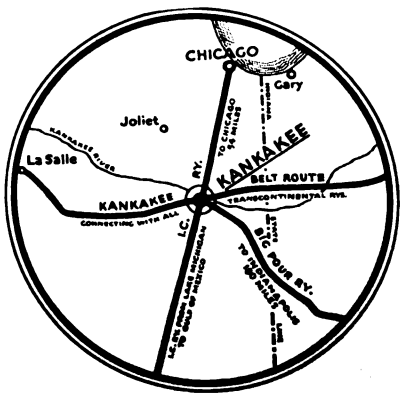
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offers you all of the advantages accruing to a manufacturer located in the great midwestern market—and none of the metropolitan disadvantages.

Kankakee is a Chicago rate basing point. Coal mines a short distance away—low cost electric power—plenty of good gas at low rates—abundant skilled and unskilled labor.

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CHAMBER OF COMMERCE KANKAKEE, ILL.



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advantage of being in Chicago and Gary steel districts.

desirable living conditions for employers and employees.

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A Basic Industry in Our Biggest Territory

(*Continued from page 21*)

dark brown with a white ruff on neck and shoulders, although spotted or white animals are also fairly common.

Alaska has suffered for years from the ignorance of the people in this country concerning its possibilities. President Harding's recent visit should do something to dispel some of this ignorance because millions of people have had their attention attracted to the Territory who would never otherwise have given it a thought. In the first place it must be understood that while Alaska is not always as terribly cold as many people down here believe, the winters up there are generally pretty long; and the summers, though extremely hot, are not long enough to grow wheat or corn. Some vegetables and some grain are grown, but agriculture can by no means be considered a staple industry.

Alaska is a large country; it is larger than England, Scotland, Ireland, Finland, Norway and Sweden combined; and those countries have a total population of about 50,000,000. Alaska will doubtless never have as great a population as that, but it will some day contain a great many more people than it does now because it is a very rich country in natural wealth.

It contains gold and silver, copper and coal and a great many other valuable minerals. It also has wonderful fisheries, but the people will need other food. Of course food could be imported, as a great deal of it is—and probably always will be. But the great bulk of its meat supply will be raised at home; and here is where the reindeer comes in.

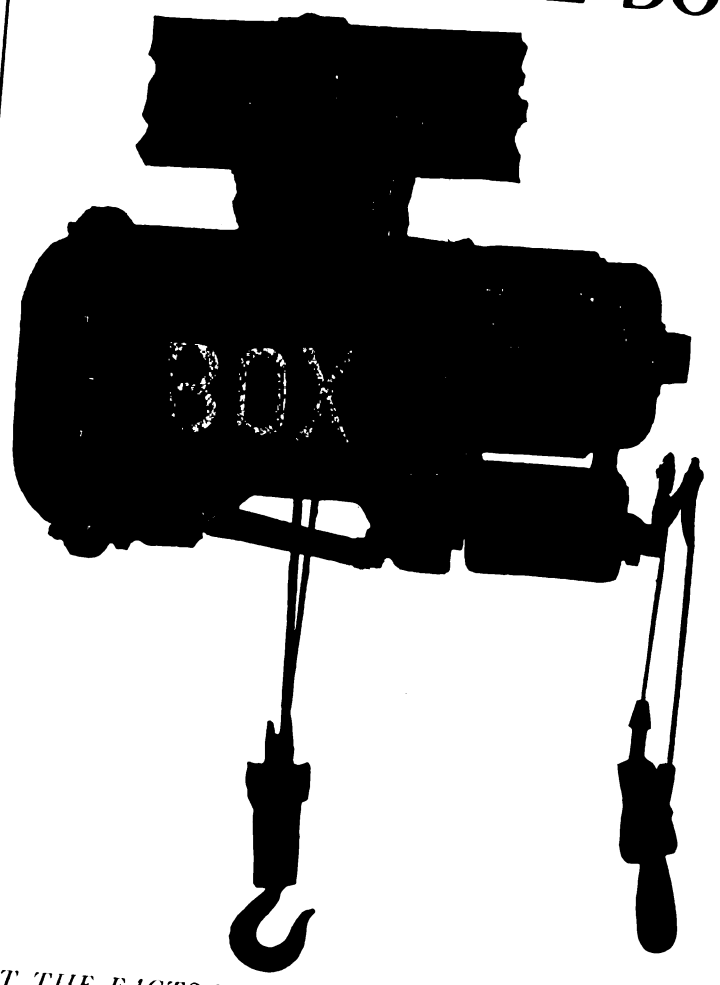
The reindeer is native to Arctic and sub-Arctic countries, and can forage for itself both summer and winter. The snowfall in the far north is very light somewhat contrary to general belief, and the reindeer does not mind the cold at all. Thus reindeer can be produced very cheaply. The land is suitable only for grazing. Practically the only expense is for herding—and two or three men can herd several thousand herd of reindeer. They can be driven long distances, feeding as they go, to the centres where the abattoirs are established.

The reindeer belongs to the same family as the caribou which is found by the million in Alaska and northern Canada. The reindeer is really a domesticated caribou. They have been domestic since before the dawn of history—in Europe and Asia—but not in America. The fact, however, that millions of caribou live comfortably in Alaska suggested the possibility of the introduction of the reindeer, and this experiment was first tried in 1892 when a few head were imported from Siberia. This was done by the Department of Education in order to render the Alaskan Eskimos less dependent upon hunting.

It had been noted that across the narrow Bering Strait the Siberian Eskimos were practi-

(*Continued on page 73*)

IT'S GOT TO BE DONE—BUT NO ONE WANTS TO DO IT



It makes no difference what the business, if there is lifting and shifting to be done, no one wants to do it.

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GET THE FACTS TODAY. The amount of time required to get a barrel, a box or a casting off or on a wagon, or moved in the plant, is heart rending to the man who pays the bill.

If you are interested in wiping this burden out of your business and at the same time speeding up work and cutting labor costs—you will want our Bulletins and data on the "Load Lifter".

The "Load Lifter" has solved many lifting problems. It is small, compact, strong and powerful. It works fast and sure. Operated by electricity. A pull on a cord lowers or lifts. No skilled labor required. Only two gears and two pinions—very simple. All parts enclosed. Can be hung up in place, or installed on an I-Beam trolley any place—indoors or outside.

The "Load Lifter" is low in cost and high in efficiency.

- Automatically lubricated from one point.
- Working parts operated in bath of oil.
- Positive Forced Feed Lubricating System reaching all points.
- Totally enclosed construction.
- Hyatt Flexible Roller Bearings.
- Ball bearing motors.
- Forged Steel Heat Treated Stub Tooth Spur Gears.
- Manganese Shafts.
- Nothing to adjust.
- Perfect control.
- Small—but very powerful.
- Adjustable Trolleys.
- Interchangeable Upper Hook and Trolley.
- Permanently aligned bearings.
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- Every bolt a fitted bolt.
- Fine workmanship throughout.

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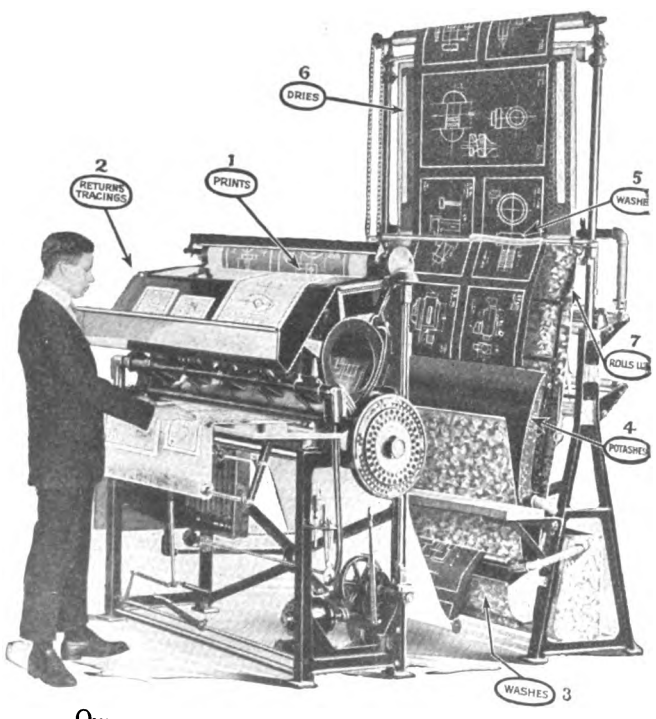
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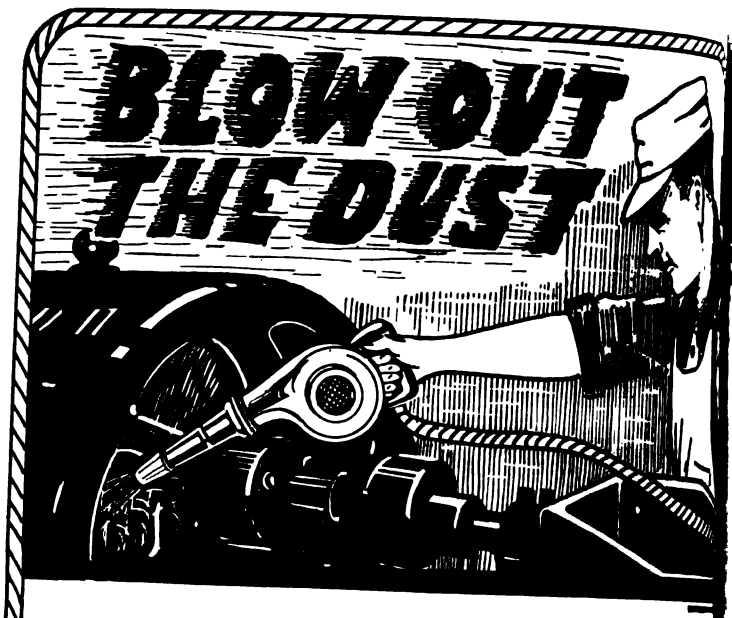
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(*Continued from page 71*)

cally independent because of their reindeer herds.

In the decade between 1892 and 1902 a total of 1,280 reindeer were imported. Today there are over 260,000 head in Alaska; and in the interval more than 125,000 have been slaughtered for food. And thus from the semi-philanthropical experiment of 1892 has developed an industry which seems destined within a few years not only to supply Alaska with its principal meat requirements, but also to augment the fast-diminishing meat resources of the world. For as population increases the range areas of the world must decrease. When land becomes too valuable for pasture the production of meat animals must necessarily be reduced.

It is estimated that the grazing areas of Alaska will support 4,000,000 reindeer. This will allow of an annual slaughter of 1,000,000, which at an average net weight of 150 lbs. a carcass will produce annually 150,000,000 lbs. of meat.

In this regard Dr. E. W. Nelson, of Washington, D. C., Chief of the U. S. Biological Survey, who formerly lived for a number of years in Alaska, and has seen the industry develop from infancy, says:

The stock (cattle) growing resources of Alaska are limited, owing to the climatic conditions, and the reindeer industry will become its most extensive and valuable meat producing resource. It will supply the demands of the Territory and yield a great surplus for exportation to the United States. The fine quality of reindeer meat will be quickly recognized and I predict it will be welcomed throughout the country as a valuable addition to our food supply.

The regulations governing the importation of reindeer into Alaska were made very strict. Reindeer could only be imported by the government and for the use of the Eskimos. The latter were prohibited from selling female animals; and in that way it was hoped that reindeer raising would remain an Eskimo monopoly.

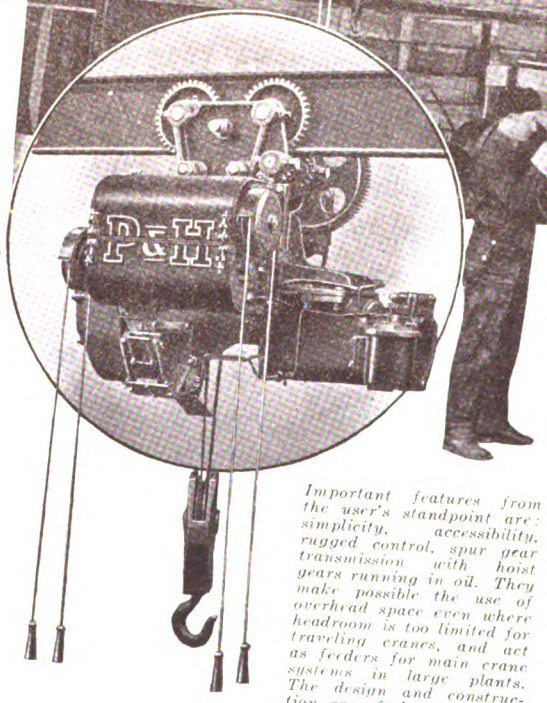
The Eskimos, however, were not accustomed to caring for animals. The reindeer needs very little attention but it does require some; and this the Eskimos were not capable of giving. To meet this contingency the department imported a number of Laplanders and their families to act as instructors. As payment for their services the department supplied these Lapps with small herds of reindeer which they were to handle on a share basis. The Lapps, however, not being wards of the government like the Eskimos, could not very well be prevented from selling their own share of the increase, and in the course of time there grew up in Alaska from this source a number of large independent herds.

Most of these privately owned herds were bought up, however, by Lomen & Co., of Nome, the pioneers in the commercial reindeer industry. This company was formed in 1914 for the purpose of exporting reindeer meat (leaving the local field to the Eskimos as well as providing a market for the latter's surplus supply).

Last year the Lomen



One of five P & H 1-2 ton Hoists on Monorails which serve this storage building



Important features from the user's standpoint are: simplicity, accessibility, rugged control, spur gear transmission with hoist gears running in oil. They make possible the use of overhead space even where headroom is too limited for traveling cranes, and act as feeders for main crane systems in large plants. The design and construction are of the same quality as found in P & H Traveling Cranes—dependable service and low maintenance are the result.

Reducing Labor Costs in Storage Sheds

Reducing the number of men required in storage sheds—releasing them for other work—is but another of the many ways in which P & H Hoists help to meet present day labor shortage.

P & H Small Hoists are used for loading, unloading and placing materials, the main monorails or spurs extending to various departments and parts of the plant as required.

They may be installed in buildings already erected. Utilizing overhead room, but little aisle space is required—only enough for the operator in traversing under the monorail. The hoisting speed of the P & H ½-ton hoists installed in the storage room above is 23 feet per minute loaded and 46 feet light.

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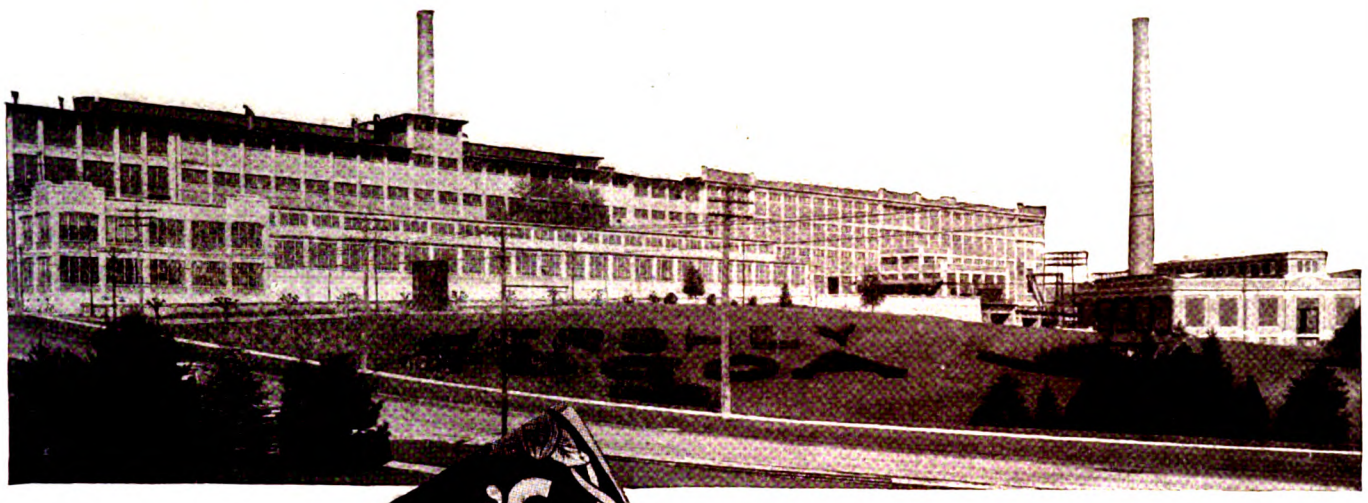
company shipped about 2,500 carcasses, and through its efforts a new table delicacy has appeared on the menus of the higher-priced restaurants and hotels throughout the United States. I say higher-priced because as yet the available supply is so small in comparison with the demand that naturally a high price can be obtained. Yet eventually it should be relatively cheap, as the cost of raising reindeer is very low as compared with cattle or sheep.

The Lomen company's herds now number about 45,000 head, and as the herds double in numbers every three years, some idea may be obtained of the rapidity with which this industry can develop. As the adult males are butchered each year they are shipped in cold storage to Seattle and trans-shipped to New York. This is a considerable haul, but even so it is not so long as the trip which an Australian mutton chop or an Argentine steak must make.

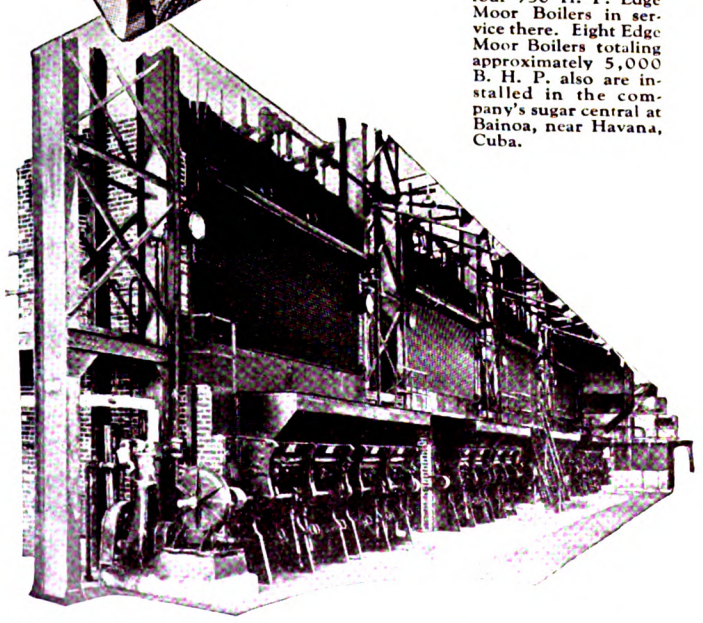
The reindeer industry has grown so quickly out of nothing that the resources of the Lomen company were strained to the utmost to keep up with it, and a few months ago Carl Lomen, one of the sons of Judge Lomen, and the general manager of the company, went to New York to seek greater financial accommodation than was possible at Nome. He has recently returned north after having secured the financial cooperation of a group of wealthy and influential New Yorkers, among whom are the Dukes, the great tobacco people, and one of the sons of the late Colonel Theodore Roosevelt. And so far as Alaska is concerned the reindeer industry is off to a flying start.

In Canada, too, where the area available for reindeer grazing is estimated to be about ten times as great as in Alaska, reindeer-raising is being undertaken. Vilhjalmur Stefansson, the famous Arctic explorer, has been chiefly instrumental in its development in the Dominion. He secured the grazing rights of about 113,000 square miles of land in Baffin Island from the Canadian government and has been successful in enlisting the interest of the great Hudson Bay Company, the pioneer in northern trade for 250 years, and they are now importing reindeer from Norway to form the nucleus of their herds. They also expect to incorporate a certain percentage of caribou into their herds, as they are larger than the domestic animals and better adapted to the country.

Now as to the quality of the meat: Those who have eaten reindeer meat as a steady diet for any length of time generally refer to it as the finest meat in the world. In Nome a great deal of beef was once imported, but reindeer meat has since displaced a considerable proportion of it—not altogether because of the cheapness of reindeer meat, but because the people generally prefer it. It has all the juiciness of beef with the delicacy and flavor of venison. Carl Lomen compares it to breast of mallard, and that description comes nearest to fitting the impression left upon my own palate.







The model plant of the Hershey Chocolate Co. at Hershey, Pa., showing new power plant at right and (below) four 750 H. P. Edge Moor Boilers in service there. Eight Edge Moor Boilers totaling approximately 5,000 B. H. P. also are installed in the company's sugar central at Bainoa, near Havana, Cuba.

DURING the past ten years the Hershey Chocolate Company has installed twenty Edge Moor Boilers, totaling more than 12,000 B.H.P., in its model plant at Hershey, Pa., and its sugar central at Bainoa, Cuba.

These boilers represent five separate orders—the first placed in 1913, the latest in 1923. The performance of the first Edge Moor Boilers at Hershey resulted in their selection for the new power plant built in 1920, and for the Cuban mill.

In the confectionery industry, as in a score of others, Edge Moor users are among the representative leaders.

The Edge Moor catalogue details the advantages of this boiler that have won it preference among discerning purchasers. We shall be glad to send you a copy.

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DO YOUR OWN THINKING

"Many plant executives whose minds are centered upon the primary purpose of production overlook or fail to appreciate the intimate relationship between production, manufacturing profits and maintenance."

From an editorial in Industrial Management Oct. 1923

It is not uncommon to find plant executives wedded to the idea that as long as production is maintained undiminished, that all is as it should be.

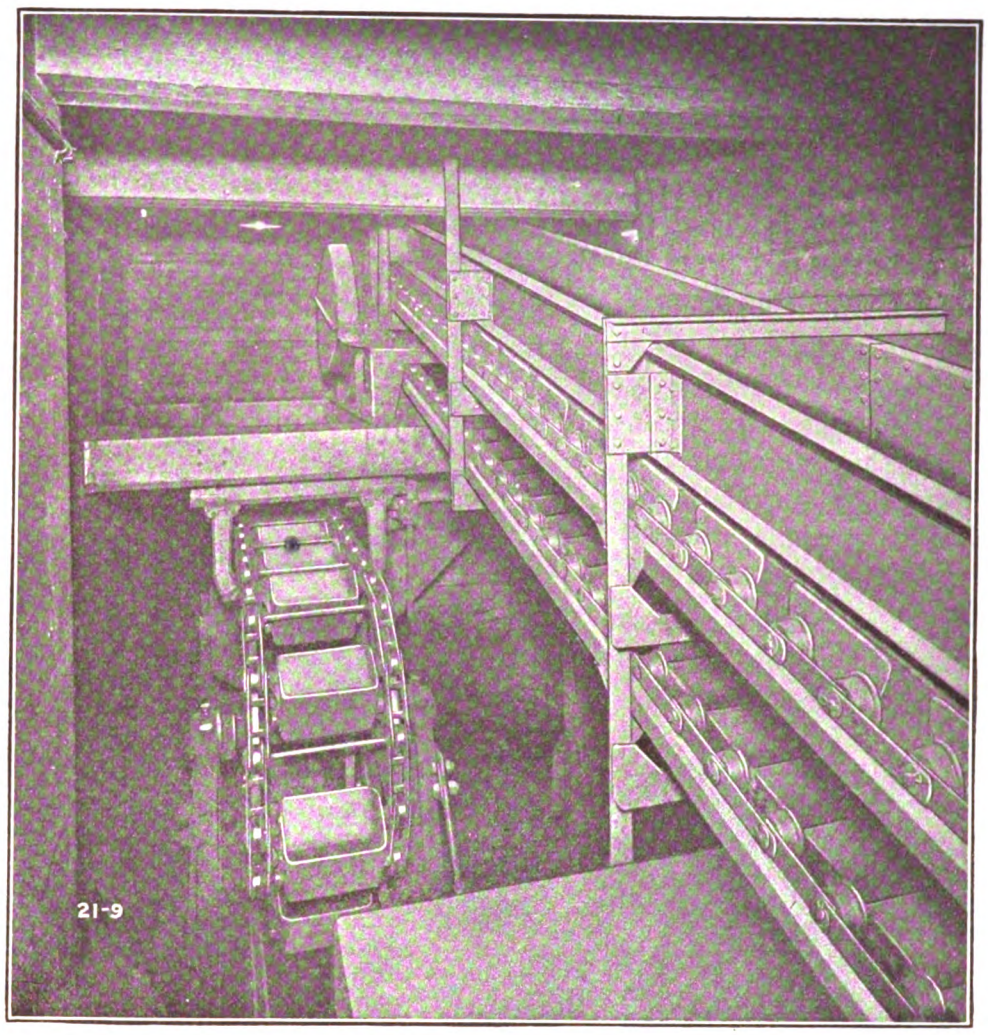
They rarely trouble themselves about the *cost* of production; resting contentedly in the doubtful security of their *book costs,* while abnormal costs —unduly apportioned—are stealthily eating away the profit.

But these slip-shod methods cannot continue, if profit is to be made and volume production maintained. The executive must *think for himself* and learn *why* his profit is not commensurate with the cost of manufacture. He must probe deep into his costs and segregate the *actual* from the *superficial.*

For example—in the matter of coal and ashes handling and rehandling. They may fail to note that inadequate apparatus is an expensive burden, which must be accounted for somewhere between the receipt of coal and the finished product. But, if they probed deep enough, they would find the loss of time for shutdowns, cost of frequent repairs and slowing-up of production will soon bring them to a realization of this fact.

On the other hand, Hunt Coal and Ashes Handling Equipment that has been carefully planned to meet not only existing needs, but to provide for future expansion as well, will prove a profitable investment and overcome in no small degree the handicap imposed on the initial cost of production by faulty or inefficient mechanism, or manual labor.

Hunt engineers, whose specialty for over half a century has been the economical and safe handling of bulk and manufactured materials in every industry, can, after a critical survey of your plant, undoubtedly suggest a remedy for existing evils or make recommendations for an entirely new layout that will cut time, labor, operation and maintenance costs to the minimum.



Hunt Apron Conveyor feeding into Pivoted Bucket Conveyor through Coal Cracker (not visible)

Hunt Pivoted Bucket Conveyors consist of a series of independent swinging buckets, free to dump in either direction. Conveyors can run in any direction, the buckets hanging in an upright position; therefore dry or liquid material can be handled without spillage.

The peculiar system of driving by pawls (of which the Hunt is the ONLY type existent), relieves the wheels of all stress. The Hunt conveyor can assume twists impossible with a sprocket driven machine.

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Watching the Pulse of the Power Plant

(*Continued from page* 17)

ditions. Where such repairs are excessive, steps should be taken to adjust operating conditions in the right direction. Pressures in the fire box are not unusual, but they have a disastrous effect upon the fire brick lining. In many cases they force the hot gases into every crack and crevice, gradually weakening supporting ironwork until it falls in, and a costly repair job is in order.

Stoker maintenance is also closely related to plant operation. A high-sulphur coal, with a low fusing point ash, is the enemy of all grates and those stoker parts exposed to the heat of the furnace. Under such conditions, high boiler ratings are not possible without excessive replacement charges. The forcing of the boilers produces a high furnace heat that melts the ash fusing it readily with cast iron. Where high ratings are necessary care must be exercised in the selection of a coal that is suitable to the operating conditions. If it is impossible to get a better grade of coal, sufficient boilers should be added to carry the load at reduced ratings, or grate and stoker repair costs will be abnormally high.

Feed waters heaters require regular periodic cleaning to get the full benefit of the heat in the exhaust steam and to maintain a high temperature of the water entering the boilers. A gradual decrease in the feed temperature indicates a fouling of the heater, causing a loss of one per cent. in efficiency for every 10 degrees drop.

The importance of the proper maintenance of steam piping is not always appreciated in the average industrial power plant. The correct installation and anchoring of steam lines is a factor that has much to do with their subsequent upkeep. Excessive vibration opens up the joints, causing leaks and requiring gasket replacements at all too frequent intervals. Sharp right angled bends in main steam lines are apt to aggravate the pulsating effect produced by a large reciprocating steam engine, thereby causing vibration and gradually weakening the line. The installation of a large receiver at the engine acts as a steam reservoir, tends to absorb these pulsations and minimizes vibration.

The care and maintenance of engine room equipment are of equal importance with that of the boiler house, since unnecessary shutdowns materially affect the production of the entire plant. There is perhaps one essential difference between a shutdown of the boiler house and a similar shutdown in the engine room, which might give the boiler house a slight preference in the matter of first importance. When the engine room is out of commission, the lights and power throughout the plants are temporarily discontinued, but when the boiler house stops work the engine room can't run and there is neither light, power, heat, nor steam for the many cooking and other pro-

In the New Hotel Statler, Buffalo & Union Trust Bldg., Cleveland

Ventilating fans, compressors, refrigerating machines, pumps, and other motor-driven machines in modern buildings are now controlled by Cutler-Hammer Standardized Building Type Controllers.

The starting and speed regulating parts as well as main line switch and overload protection are enclosed in one safety cabinet—incorporating the ideas of leading architects and engineers, the requirements of the National Electrical Safety Code, municipal and state codes, and the Electric Power Club.

A standardized line of this type, the result of years of development work by the Cutler-Hammer engineering force, eliminates the added cost of special controllers. In the enclosed types the incorporation of main line switch and overload protection makes for better appearance, reduced installation expense, less wiring, fewer conduit fittings, and greater safety. The "C-H" trade mark identifies this standardized line.



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cesses. All energy in the plant is stopped.

Furthermore, engine room troubles are usually audible and are detected by the sound produced, or indicated by suitable gages provided for the purpose. Boiler room troubles often develop within the boiler shell, in the furnace or in some equally well-obscured location, unseen and unheard, until they make their presence felt in the form of a complete shutdown.

Engine room troubles must not be minimized, however, simply because they give their distinctive warnings. Once the warning is given, it is not always easy to locate the seat of the trouble. Nor is it always a simple matter, after the trouble is located, to apply the remedy.

On every well-designed engine there are many parts that require regular inspection. The assurance of efficient and reliable operation of the unit depends upon the proper functioning of its vital parts. The oiling system and all oil leads, ducts and holes must be kept open and free. No lubricated part must be allowed to run dry. Insufficient oil is indicated by heating of the bearings. They may even smoke, but if the condition goes unnoticed, the bearing will become so hot that the babbitt metal will run out and the engine is down for repairs.

Gland packings should be kept tight enough to prevent leakage. If they are too tight, however, they increase the friction load of the engine and may even score the piston rod, making it impossible to stop leakage. Excessive leakage means worn or faulty packing, which should be replaced at once.

Piston rings must be a perfect fit in the cylinder or they cannot maintain a steam tight seal. Leakage by the piston rings causes power losses and results in excessive steam consumption for the horse-power developed.

Lost motion due to loose joints in the valve gear, connecting rod bearings or elsewhere, makes its presence known by a distinct knocking. This looseness should be taken up to prevent excessive wear and irregular operation.

In a turbine plant the most vital parts requiring attention are the main and thrust bearings. These units operate at very high speeds and bearing trouble develops in an incredibly short time, if operating conditions are unfavorable. The lubrication system of the turbine is its vital spot and must be absolutely free from foreign matter and clear at all times.

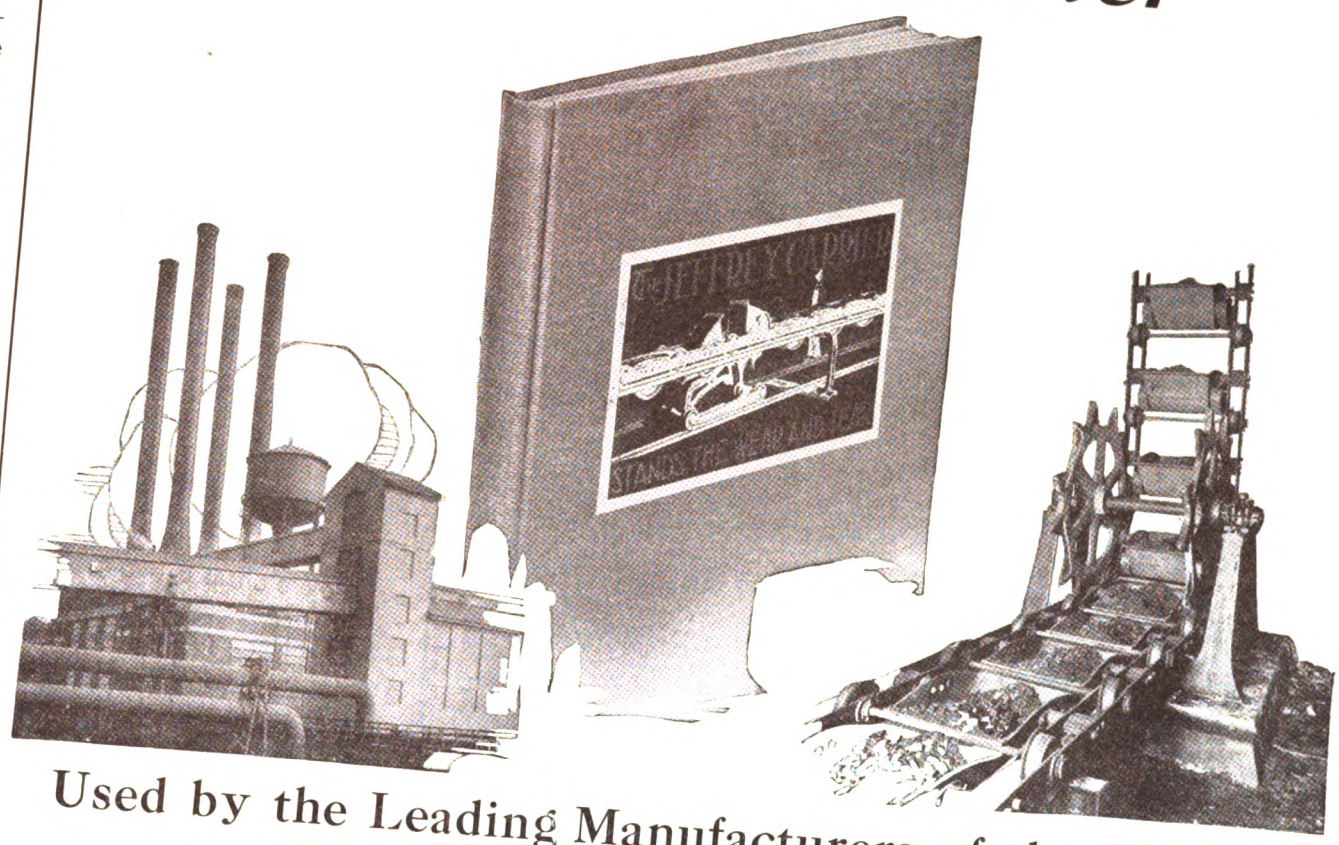
Turbine auxiliaries, however, usually require more attention than the turbine itself. The auxiliaries include condenser pumps, vacuum pumps, circulating pumps, etc.

The most usual engine room trouble is a hot bearing, due either to incorrect adjustment, improper alignment, poor oil or too little of it. When the bearing becomes too hot the journal cuts into the bearing metal, small bits of which fill the bearing clearance and increase the heating effect by their friction.

Cylinder heads are sometimes cracked by the admission of large slugs of water into the cylinder with the live steam. Such accidents are

(*Continued on page 79*)

The JEFFREY— Pivoted Bucket Carrier



Used by the Leading Manufacturers of the World

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Armour & Co.
Upson Nut Co.
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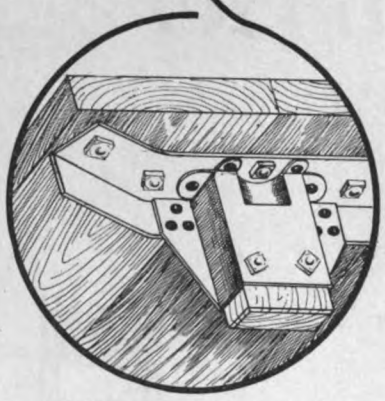
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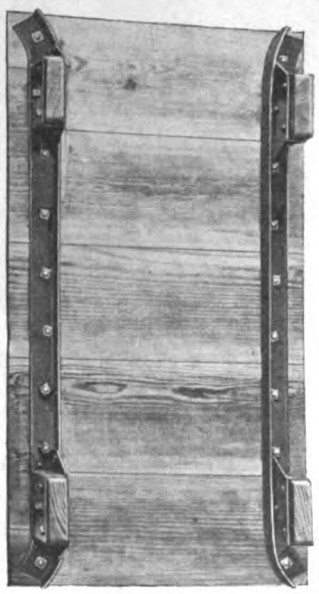
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Riveted Hydraulically Not Bolted

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No amount of bumping and hard knocks can loosen the steel legs from the runners. Ordinary bolts soon work loose and increase maintenance costs considerably. Hydraulically driven rivets eliminate the possibilities of them working loose.

This is only one feature of the rugged design of "Hallowell" lift truck platforms.



There is the substantial platform top, the wooden legs set on the end of the grain and the special design of the "Hallowell" curved steel runners, which allow lift trucks to slide under easier without damage to sides, no matter from what angle the lift truck hits the platform.

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Whenever rollers are used, Conveying Systems, Steel Mill Tables, and the like, maximum neck-strength is required because here the strain is most severe. Wharton rollers are made in one-piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained.

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We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.



Cross-Section Showing Hollow Construction

Wm. Wharton Jr. & Co., Inc.

(Founded 1859)

30 Church Street, New York, U. S. A.

Cable, Whilwharton, New York

All Plant Growth Requires ROOTs



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(*Continued from page 77*)

prevented by properly draining the cylinder and steam line before starting up, and by the installation of suitable separators in the steam line where it enters the cylinder.

The loss of production from a shutdown or stoppage in the engine room may so far exceed the cost of proper maintenance, or even the cost of power, in many cases, that almost any reasonable expense is justified if it will result in keeping the engine turning during the working hours of the plant.

The steel industry reflects, perhaps as clearly as any other, recent irregularities in business trends. Production, as in most lines of manufacturing, has declined from the peak reached earlier in the year. Average daily output of ingots in September was 132,534 gross tons, or 16 per cent. less than in April, but greater than in any month in 1922. Unfilled orders of the United States Steel Corporation have declined in greater degree—32 per cent. from March 31 to September 30. Prices of steel on the whole, however, have remained practically unchanged since April.

As regards the volume of domestic demand in 1923, the steel industry has occupied an especially favored position. It is generally recognized that the building and automobile industries were outstanding factors inducing the remarkable expansion of general business in the early part of this year. A third important factor has been the program of the railroads for upkeep and for expansion of equipment.

These have all directly enlarged the market for steel products. Moreover, the extraordinary requirements of the petroleum industry for piping and tanks, as well as the uses for steel in the vast road-building programs in many sections of the country, have furnished additional outlets for the products of the steel mills. Particularly in the building and transportation industries, deferred demand has represented a significant addition to current requirements. Shortages had developed during the war and the subsequent period of depression.

The distribution of steel in 1922 among the chief steel consuming industries gives an indication of the relative importance of these industries in the markets for this commodity. According to estimates by The Iron Age, the principal consumption of finished steel by industries, expressed in percentage of total rolled steel production, was as follows: railroads, 22 per cent.; buildings and other construction, 15 per cent.; automotive, 10 per cent.; and oil, water, gas, and mining, 10 per cent. Experts accounted for 7 per cent. of the total; the remainder, 36 per cent., representing consumption by a wide variety of industries. It is not to be assumed that last year's distribution was normal. Consumption by the industries, relatively as well as absolutely, varies greatly from year to year. In 1921, for example, when the production of finished steel was greatly below that in 1922, the railroad and automotive industries each took only about one-half as much of the output proportionately as in the latter year.—*The Guaranty Survey.*



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The manufacturer who buys shipping boxes upon "price" alone invariably pays the biggest premium.

TOO often, low price is the paramount factor in the selection of the shipping box. Those greater costs that pile up later, in damaged shipments and broken goods, are seldom reckoned —or if reckoned they are passed over as expense that cannot be helped.

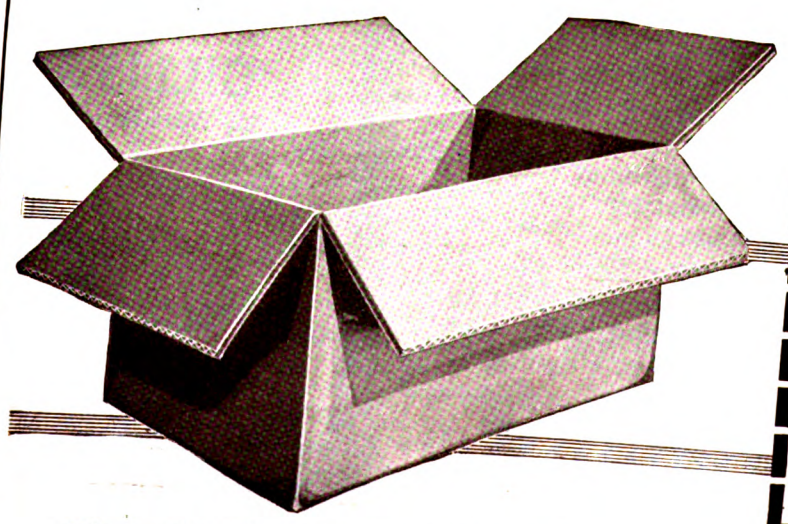
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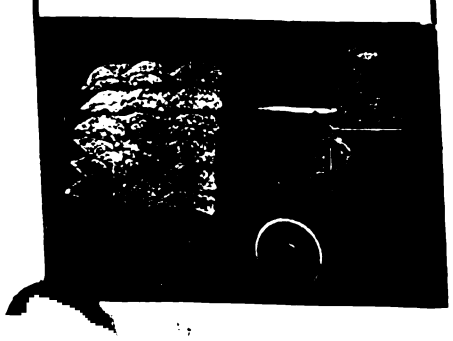
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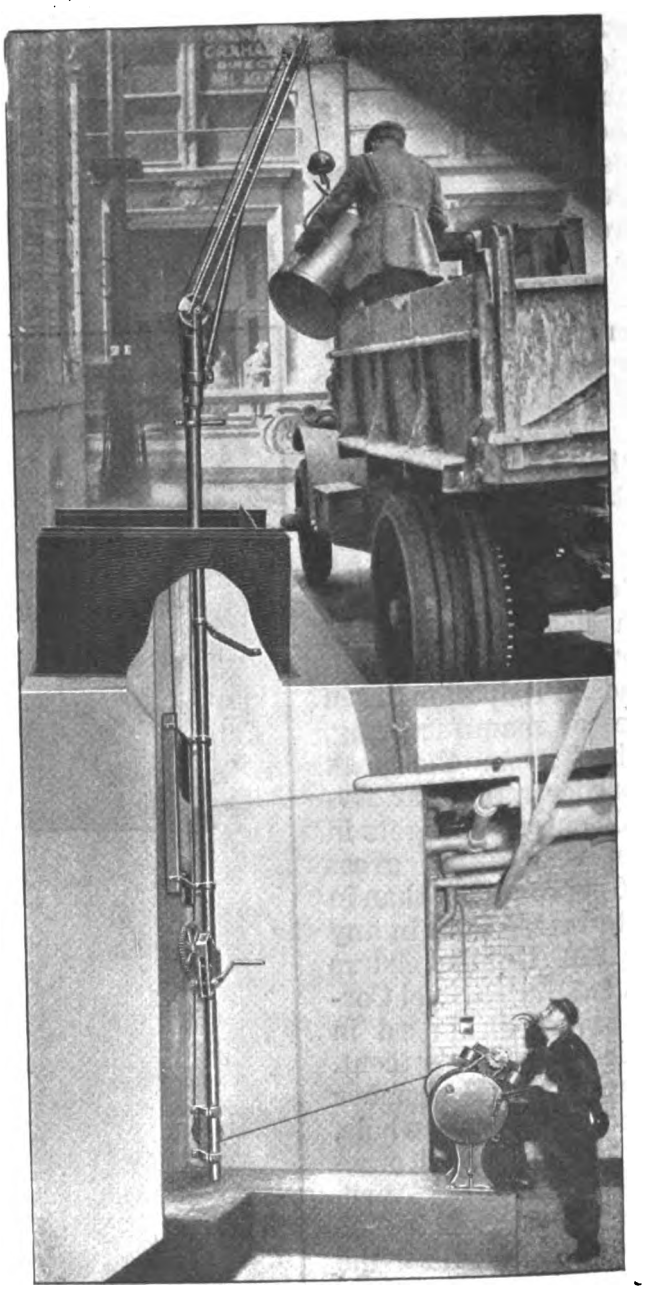
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The G&G ELECTRIC REG. U.S. PAT. OFF. Telescopic Ho

Good Lighting and Prosperity

(*Continued from page 20*)

conditions indoors. Many researches have been conducted in recent years with various objects such as the elimination of glare and the consequent eyestrain, the increase in the safety of the workman, the reduction of spoilage, and the increase in production. The latest one conducted by D. P. Hess and Ward Harrison[1] showed an increase in production of 12.5 per cent., on increasing the intensity of illumination from 5 foot-candles to 20 foot-candles. The important point is that this 12.5 per cent. increase in production was achieved at only a small additional expense for lighting which was only 2.4 per cent. of the payroll. In the series of experiments conducted there was a definite increase in production for every increase in the intensity of illumination.

In many cases the lighting is not only inadequate but so improperly and inefficiently done that increase in production, lower spoilage and greater safety can be achieved by merely rehabilitating the lighting system without increasing its actual operating cost. It is always surprising to students of lighting that mankind will ignore such an important factor as lighting. And yet this is just what is being done on every hand. A few years ago W. A. Durgin[2] conducted a series of tests which showed increases in production as high as 100 per cent. when poor lighting was changed to adequate and proper lighting. In one case when increasing the intensity from 3 foot-candles to 12 foot-candles a 10 per cent. increase in production was achieved at an increased cost of 1.2 per cent. of the payroll. In another case an increase from 4 to 12 foot-candles increased production in various departments an average of 15 per cent. Such evidence is growing yearly and combining with this the philosophy of the earlier paragraphs of this article we cannot avoid the conclusion that better lighting, which is certainly needed from the standpoint of the welfare of workmen, will pay other large dividends to the industry itself in greater production.[3]

Of course, there are many factors influencing such researches so that to be conclusive they must be elaborate. Some of these have been conducted in an approved manner which gives weight to the evidence. But let us take the clearly defined process of reading. The writer has shown[4] that an average increase of 15 per cent. in the speed of reading black print on white paper resulted from an increase of the illumination intensity from 4 foot-candles to 16 foot-candles. When reading black print on gray paper the increase in the speed of reading was 50 per cent. for the same

1. 1923 Convention of Illuminating Engineering Society.

2. Trans. of the Illuminating Engineering Society Vol. XIII., 1918 p. 417.

3. Artificial Light—Its Influence on Civilization, M. Luckiesh, The Century Company, 1921.

4. Journal of the Franklin Institute, Vol. 192, 1921, p. 757.

Stop up the profit-draining hole of manual load handling

FOR example, it made it possible for one concern to effect a 43% reduction in handling costs.

Many executives have unexpectedly found a surprising number of these "holes," through a casual stroll through the shop or warehouse.

Here, two or three men loading a factory truck—when one, with the proper equipment, could do the work. There, five, six, or more rehandlings of materials on their way through progressive manufacturing operations and storage—though all could be easily eliminated.

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increase in illumination intensity. This increase in "speed" translated into terms of operation and production adds more evidence.

Let us return again to the matter of quality or color-value of light. There is no question that daylight is the best quality of light for accurate color-discrimination. The evidence is found on every hand. However, daylight is variable in quality as it is in quantity. North skylight has been accepted as the best daylight for color-work but not because it is inherently best but because it is the most uniform skylight both as to quality and quantity. There is no desirable daylight quality that can not be provided by artificial means. Artificial north-skylight and artificial sunlight are available in the form of colored glass filters for use with Mazda lamps. There is also the so-called Mazda "daylight" lamp which provides an approximate average daylight satisfactory for most work.

A recent investigation indicates still further the desirability of light approaching daylight in quality. The test involved reading black print on white paper and color discrimination obviously was not involved. The printed page was illuminated alternately by light from regular Mazda lamps (with clear bulbs) and from so-called Mazda daylight lamps of equal wattage. Notwithstanding the fact that the intensity of illumination on the reading matter was only 2/3 as great with the Mazda daylight lamps as with the regular lamps the majority of thirty-five readers favored the light of the former which approaches daylight qualtity.[5] The range of intensities was from less than a foot-candle to nearly 30 foot-candles.

Thus we see a constantly increasing amount of evidence favoring higher intensities of a light approximating daylight in quality. Artificial lighting has been developed to a high state of control. Quantity, direction, diffusion, and quality are under almost complete control. Doubtless, many buildings of the future will depend solely upon artificial light just as some of them depend even now upon artificial light. However, natural daylight will always play an important part in the industries excepting in very congested districts.

Much good work has been done in the development of daylighting but let us look for a moment at the neglect of these installations. On every hand in the industries we see expensive daylighting equipment depreciating through lack of maintenance and cleaning. The cost of daylight in our factories and other interiors is comparable with that of good artificial lighting. In many cases the cost of daylight is even much greater than that of artificial lighting, for we must charge interest on the extra cost of glass areas over that of the walls or roof; maintenance; heat losses; cleaning; etc. But having this investment (and in many cases we will always have daylighting equipment if for no other than the psychological reason) it should be maintained in order

(*Continued on page 84*)

5. Light, November 1923.

WORTHINGTON

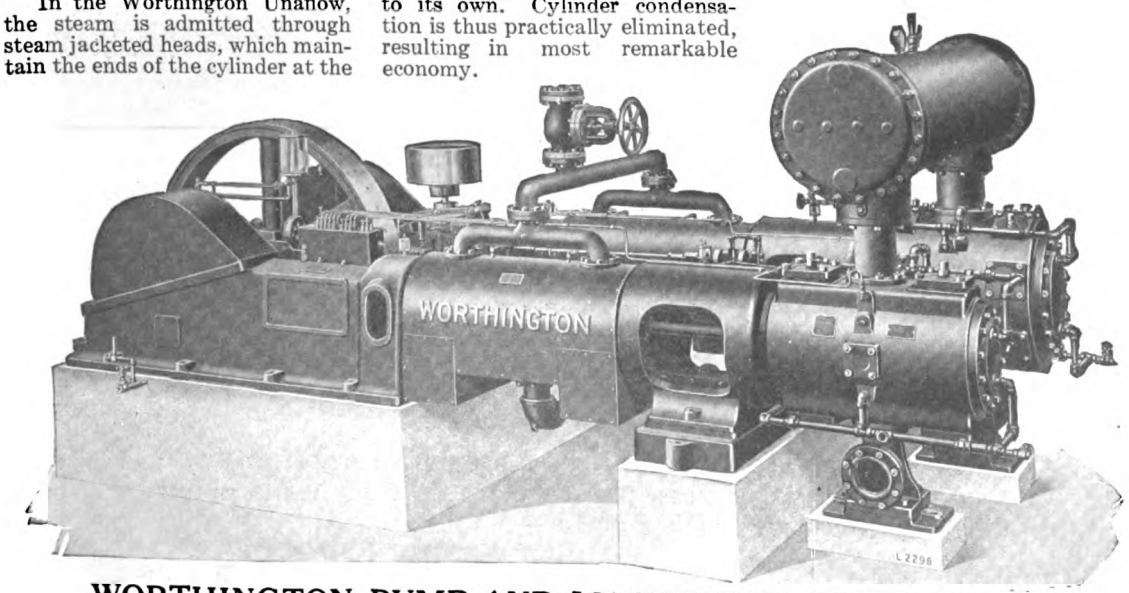
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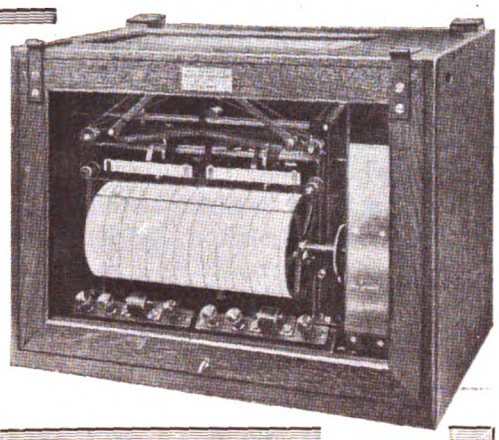


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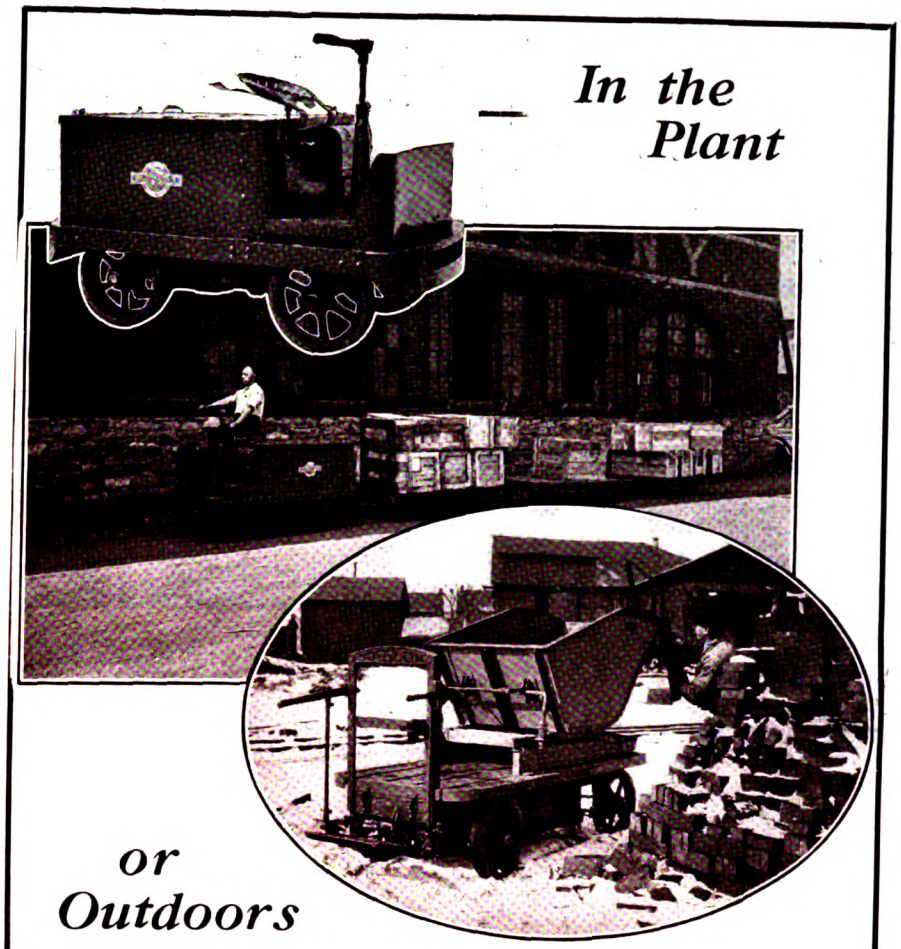
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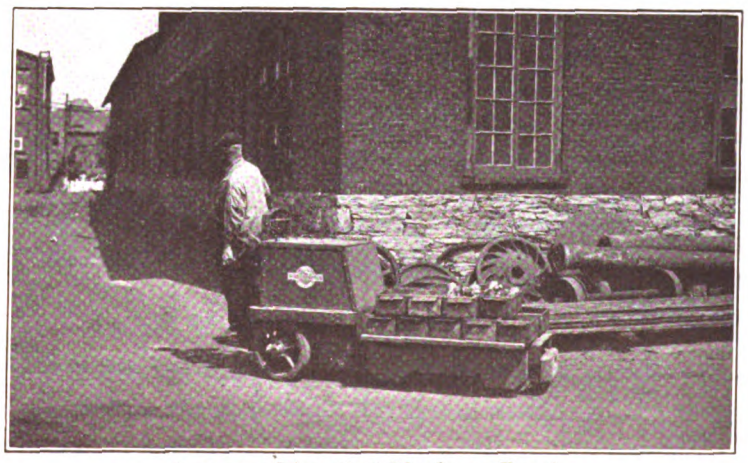
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Crescent Elevating Platform Truck

TRUCKS CRESCENT TRACTORS

CRESCENT

ELECTRIC TRUCKS & TRACTORS

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(*Continued from page 82*)

to realize the best production, the greatest safety, and the least spoilage. However, let us look at the following measurements of the transmission of light by glasses taken at random from the daylighting equipment of various factories; the measurements being made by scientific apparatus.

Transmission of Light

Specimen	Before Cleaning	After Cleaning	Increase
1 Clear	12%	88%	7.3 times
2 Clear	16%	88%	5.5 "
3 Ribbed	14%	80%	5.7 "
4 Ribbed	17%	76%	4.5 "
5 Ribbed	0.3%	75%	250.0 "
6 Wavy	13%	80%	6.1 "
8 Wavy	5%	75%	15.1 "

It is seen from these measurements that, if the daylight illumination intensity in these factories depended solely on the transmission of light through these glasses, the intensity of useful light would increase from 4.5 to 250 times, after a thorough cleaning. These are not unusual cases, because glasses in the industries are subject to severe conditions. Dust, carbon scale, and even acid fumes are common and the glasses are bound to become opaque if uncared for. It is not the easiest matter to clean dirty glasses but fortunately harmless cleaning compounds are available which do the job at a reasonable cost. Just as progressive manufacturers are finding that adequate and proper artificial light increases production and reduces hazards, so are many of them finding that it pays very well to clean the daylighting equipment.

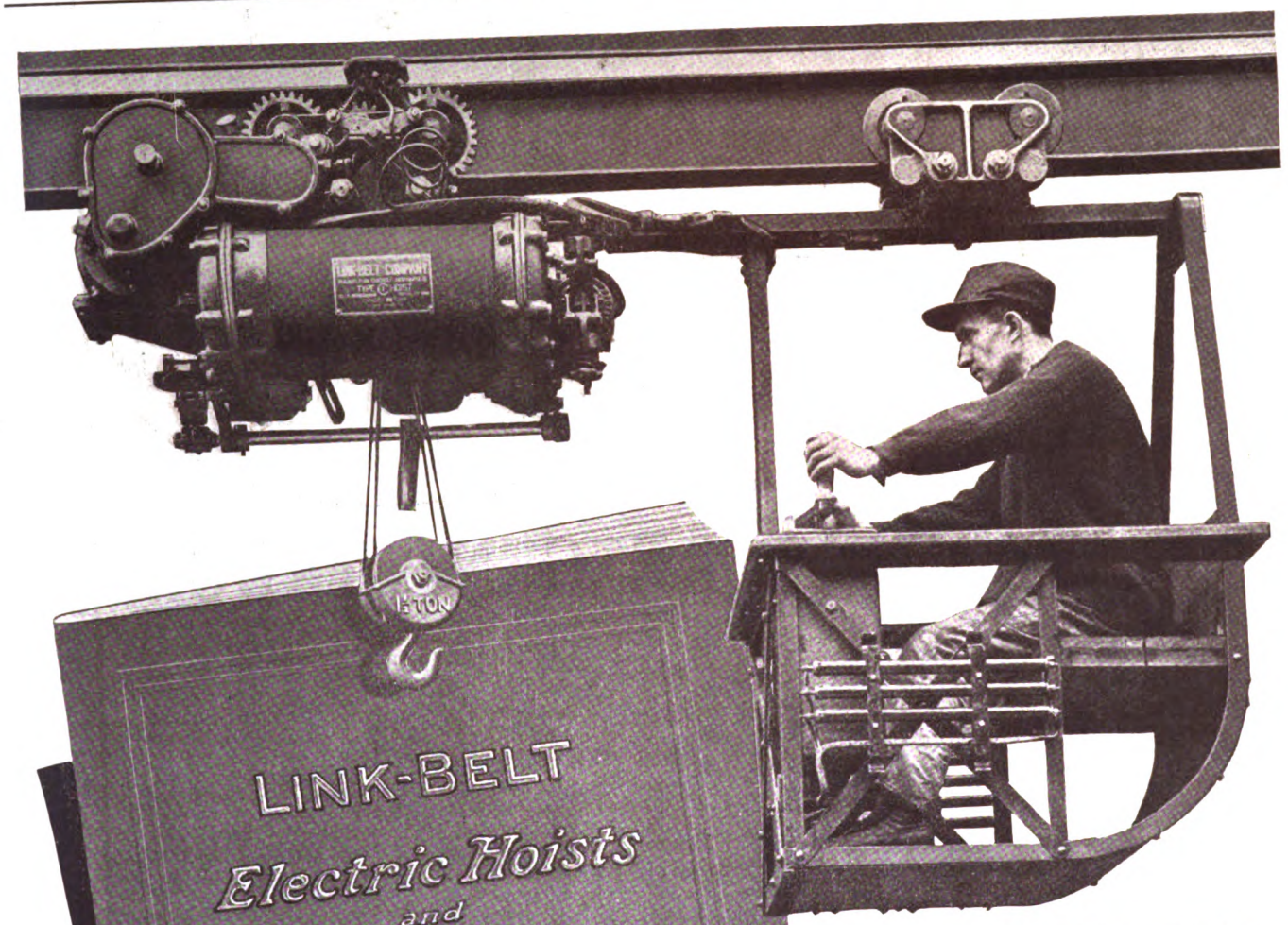
As an example of the efficacy of cleaning glass areas in factories let us quote from an official survey made in a portion of one of the plants of Joseph T. Ryerson and Son, Inc.

"The use of ..... in cleaning 16,000 sq. ft. of skylight in our Jersey City warehouse saves $7,153.60 a year due to increased production and decreased illumination cost. The improved light also reduces accidents fully 10% and eliminates about 5% of the errors in filling orders.

"With better light the whole spirit and atmosphere of our plant changed. The workmen found the conditions far more pleasant and became better satisfied with their jobs. Eye-strain was greatly reduced. On the whole the effect on the workmen was most gratifying.

"As a result of the improved light our men accomplished more work, in fact we attribute a 5% increase in production to this source. Since there are 100 men, this is equivalent to saving the wages of 5 men, or $7,500.00 a year.

"There are other equally important advantages which are hard to express in dollars. For example: Among the men doing angle piling, cuts, abrasions, and other minor accidents were quite common. On other kinds of work major accidents are bound to occur in spite of all precautions. The increased light in our plant has easily reduced accidents by 10%, with a consequent saving in



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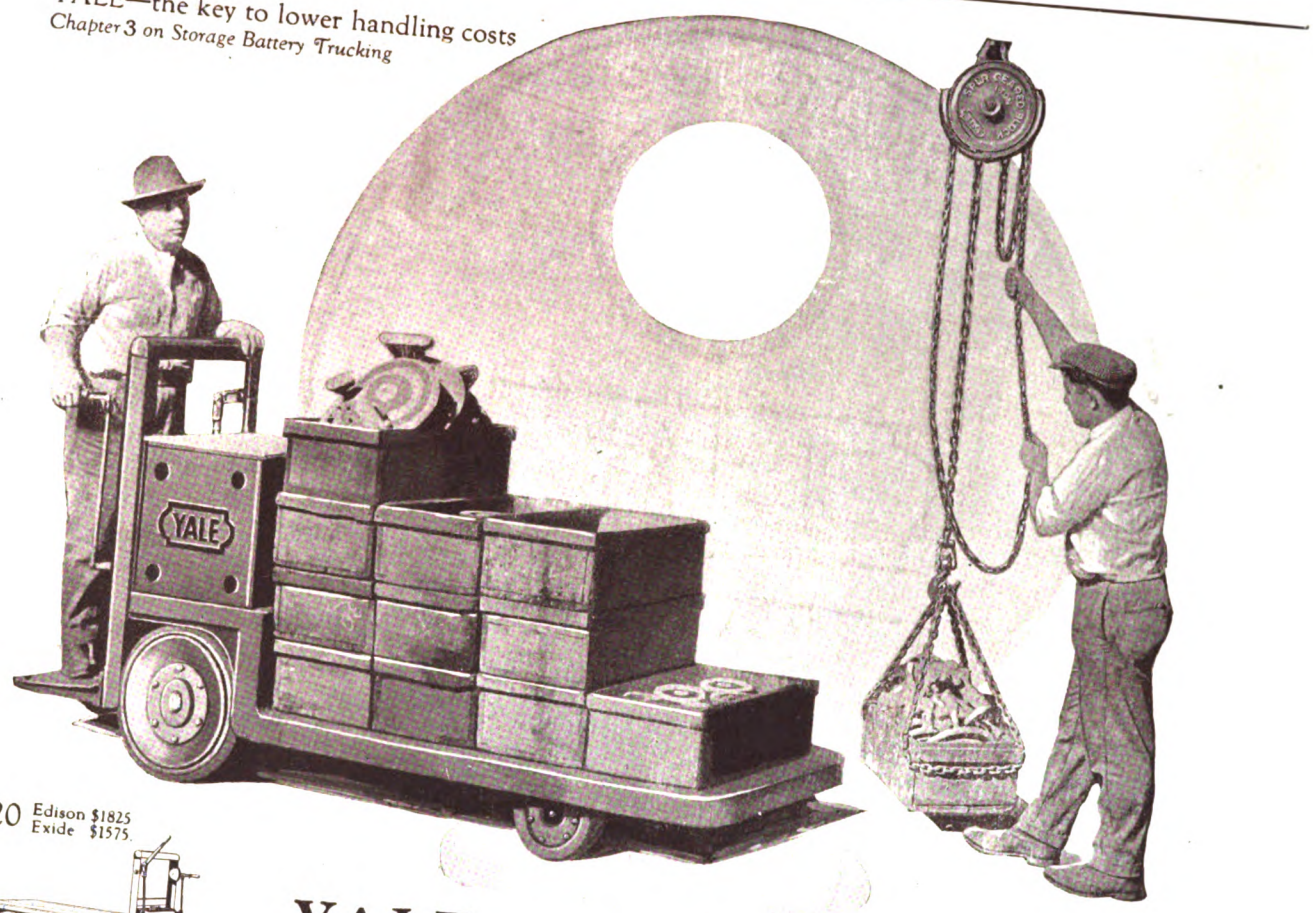
"We feel certain that the number of errors in filling orders has been reduced at least 5% by the improved light. This results in greater customer satisfaction—a most important asset. It also saves the cost of handling claims and trucking orders incorrectly filled.

"Labor turnover is affected by so many factors that it would be difficult to prove the effect of better light on this important cost. However, there is no doubt that our men appreciate the more pleasant working conditions, and that this will affect labor turnover favorably."

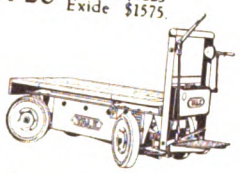
The report contains many other details and ends with a statement that the net saving "repays the cost of the cleaning compound more than twenty-eight times."

In closing, let us repeat that light is essential to human activities. As we progress into this present scientific age we are finding that not only light but adequate and proper lighting are also essential if we are to keep the pace with the competition of neighbors and of nations. The best lighted industry, other things being equal, is the most prosperous industry. The best lighted country—the United States—is the most progressive country. The lighting of this country has not reached a high standard by any means. It leads other countries because the lighting of other countries is so poor. However, lighting is rapidly developing and its benefits are being proved every day. If we are to enjoy the luxuries of the present age we must harness everything that increases production. If we are all to enjoy automobiles, radio, our own homes, etc., we must increase the production of our present factories even further. When we have done the best possible with daylight and artificial light the latter must be depended upon for an extra shift. Possibly we must go eventually to the two-shift day in order to get even more production from the same overhead. But leaving out production, we are finding on every hand that good lighting, whether natural or artificial, makes the worker happier and arouses pride of workmanship and of personal appearance. It is in darkness or gloom that discontent, viciousness and crime flourish best. We owe it to ourselves to harness light to increase the safety, the efficiency, the productiveness, and the happiness of mankind. This is best done by taking from Nature that which is good for us and improving upon it to suit best our needs that we ourselves are responsible for because we have built this artificial world that we call Progress.

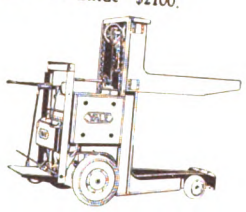
YALE—the key to lower handling costs
Chapter 3 on Storage Battery Trucking



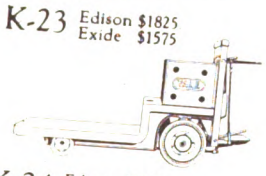
K-20 Edison $1825 Exide $1575.



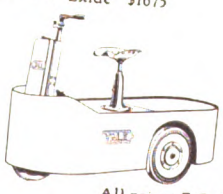
K-22 Edison $2350 Exide $2100.



K-23 Edison $1825 Exide $1575



K-24 Edison $1925. Exide $1675



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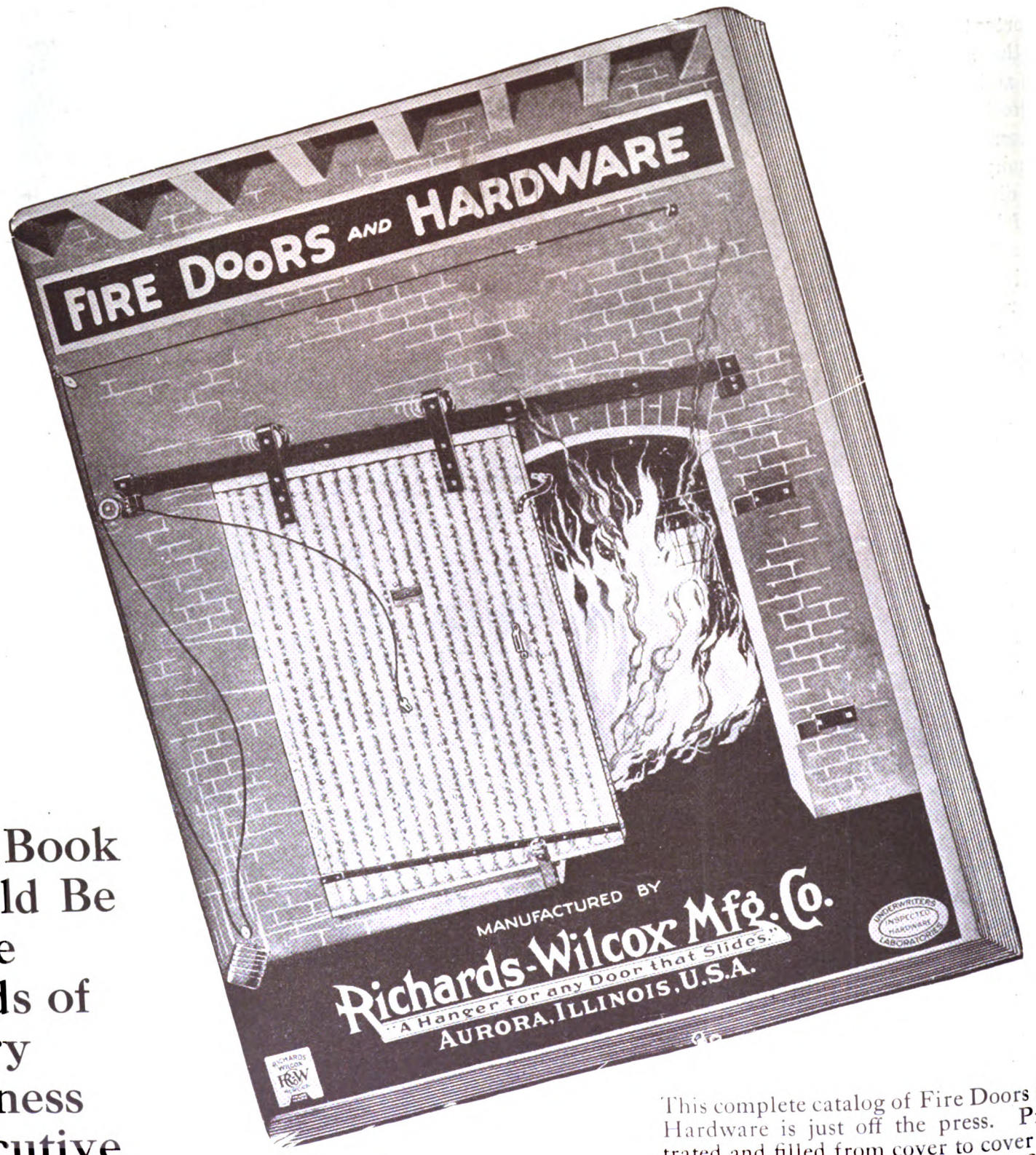
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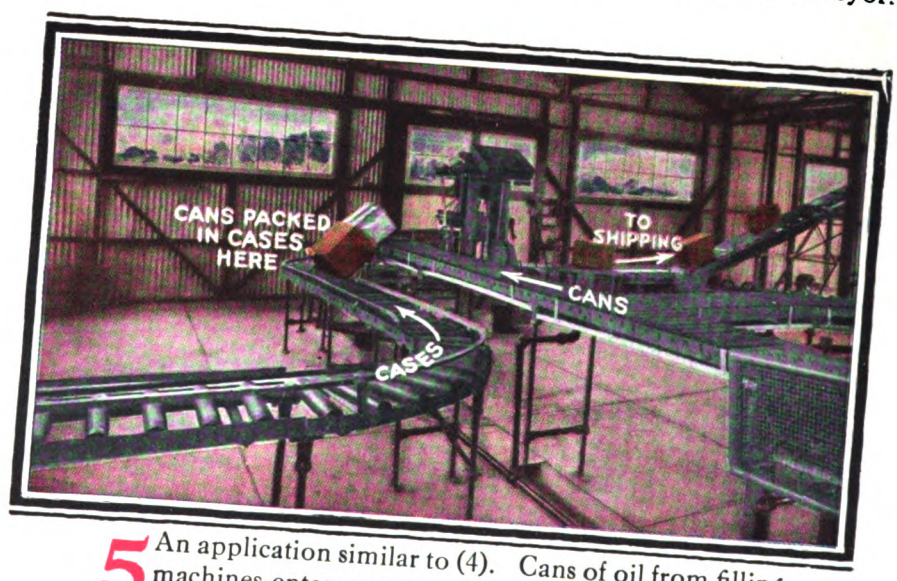
2 Where small parcels are shipped in quantity, the operators who pack, seal, address and weigh the product are located alongside of a moving belt, which carries the packages away.



3 Packages of product are most economically weighed as they pass along the shipping room conveyor. Packages are also sealed, nailed and addressed on the conveyor.



4 The making of the packing operation an integral part of assembly is a money making plan that should be widely adopted. Picture shows finished devices coming from one assembly line by two chutes to the operator who boxes them, and packs the boxes in cartons, ready for shipment.



5 An application similar to (4). Cans of oil from filling machines enter on conveyor at right; cases from the box shop enter at left. An ingenious mechanical contrivance tips the cans into the boxes, as shown in the photograph. The filled boxes are then conveyed to nailing and shipping.

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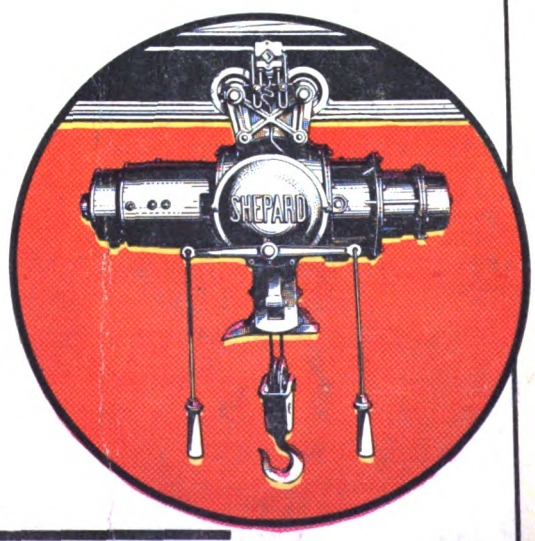
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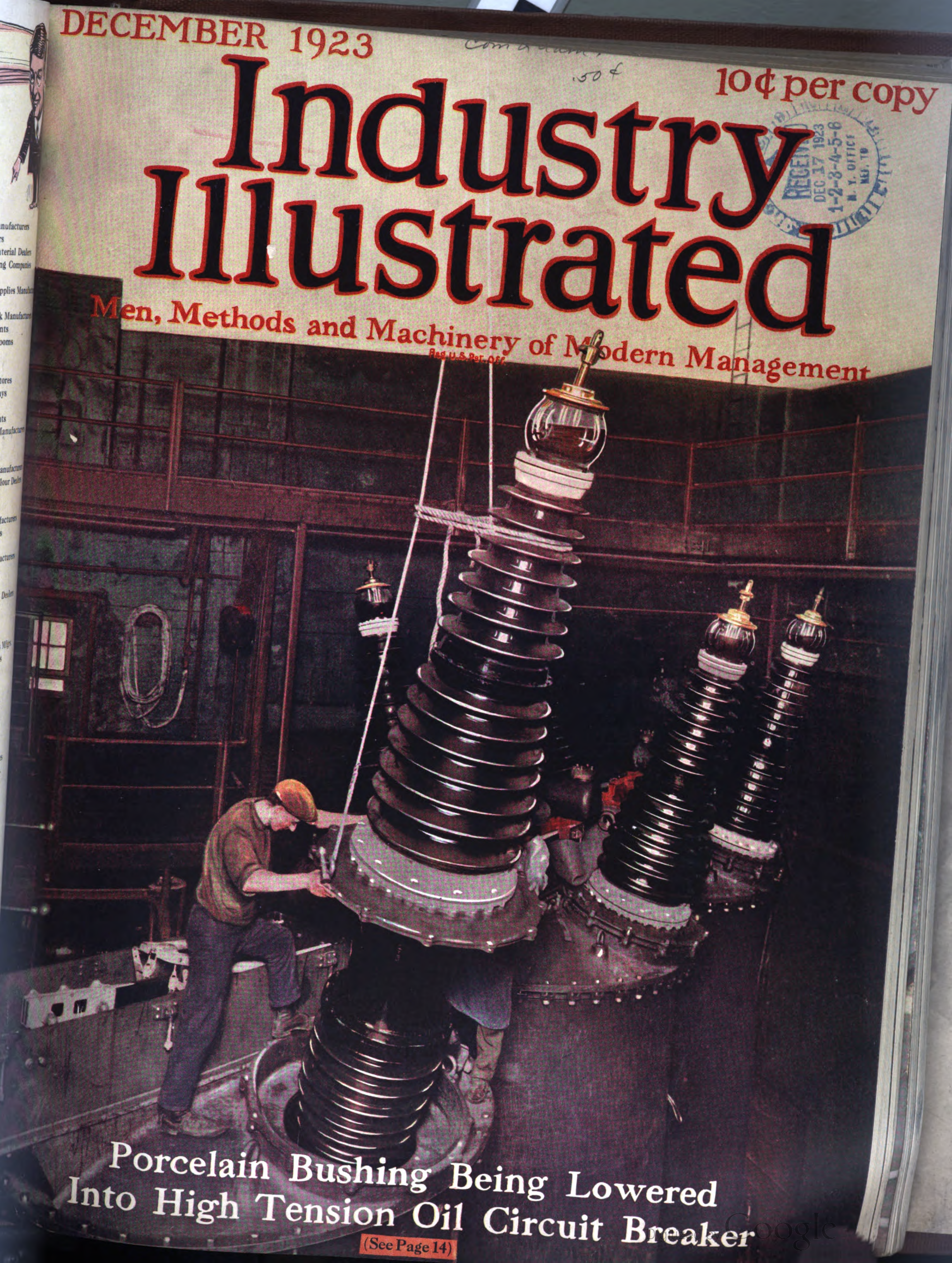
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(See Page 14)

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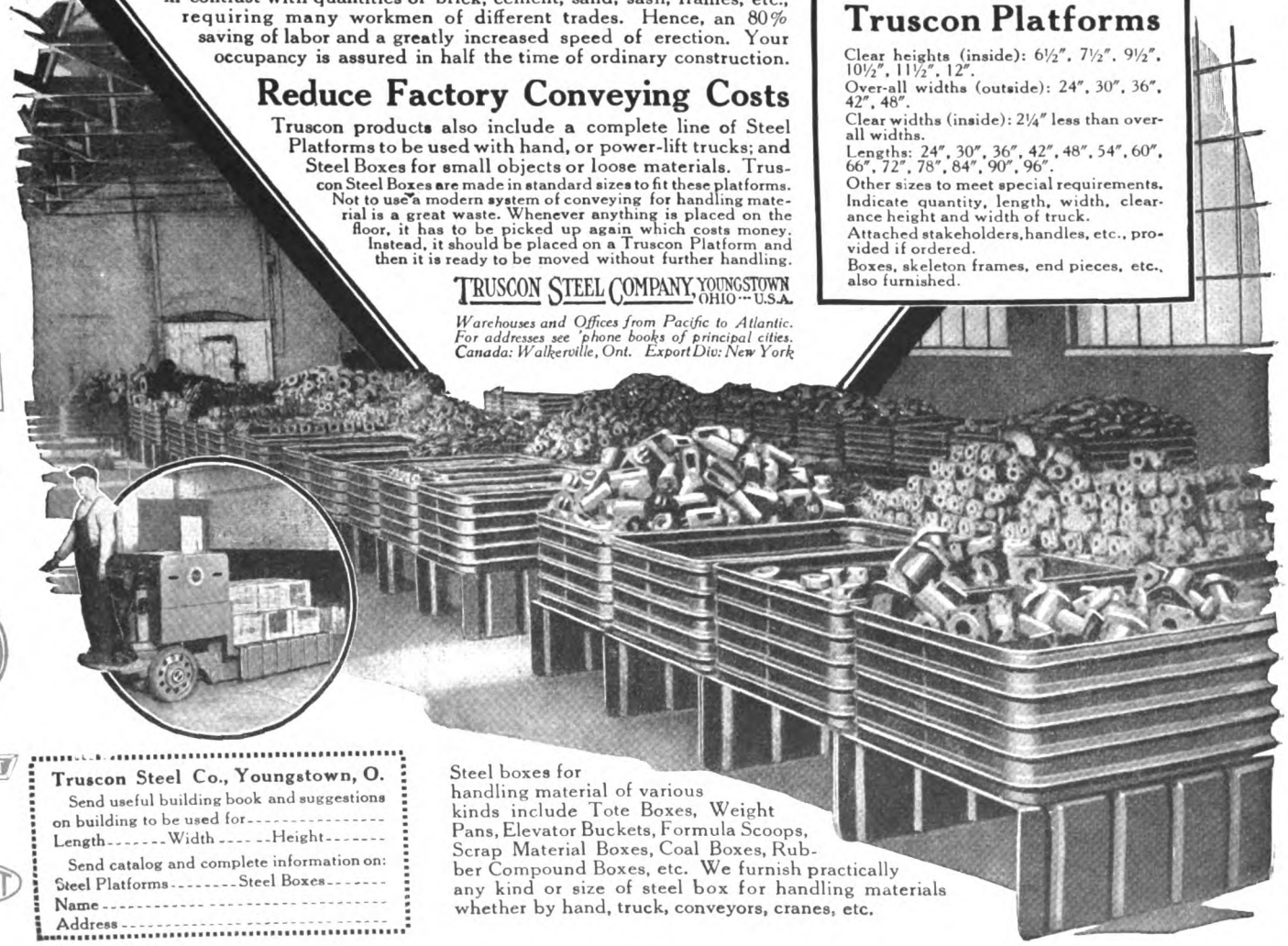
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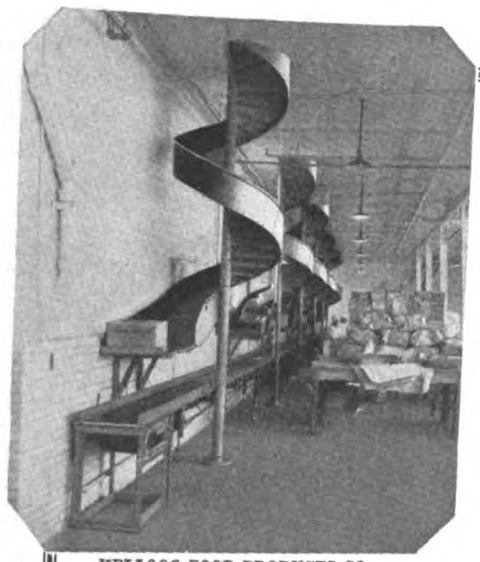
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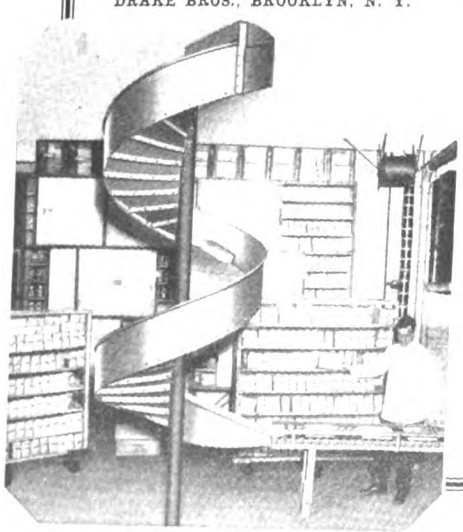
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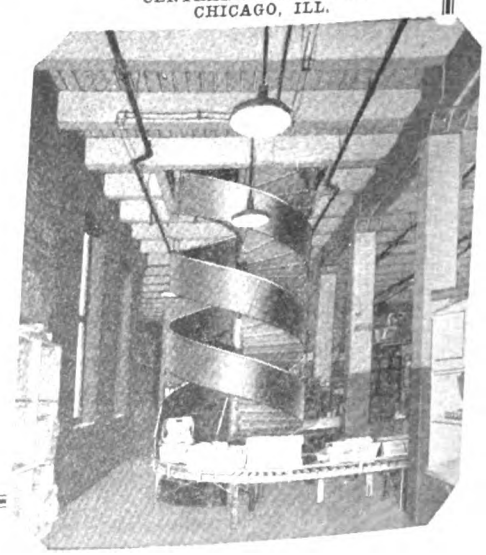


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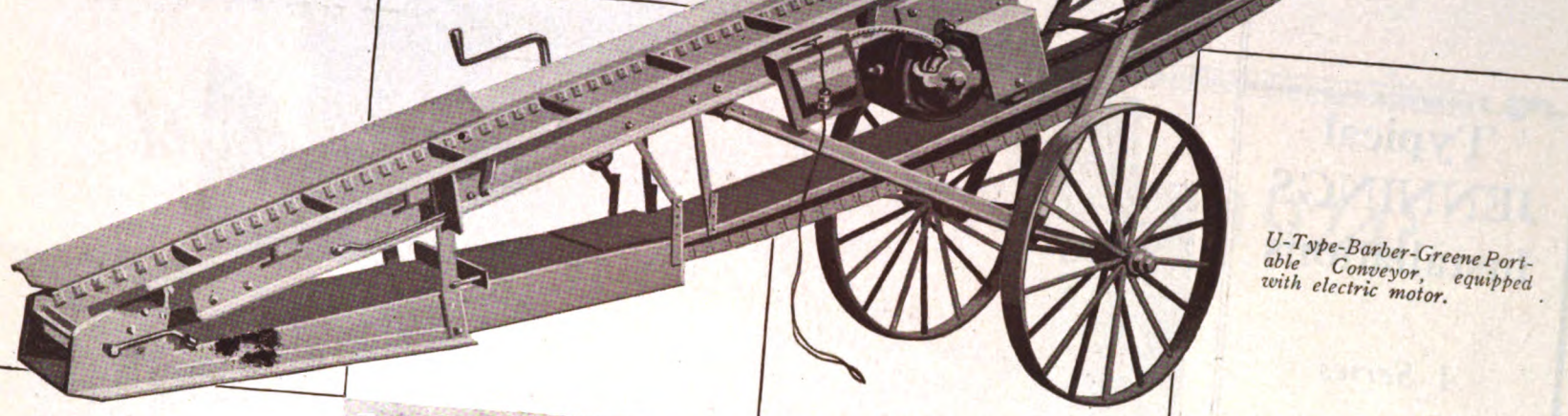
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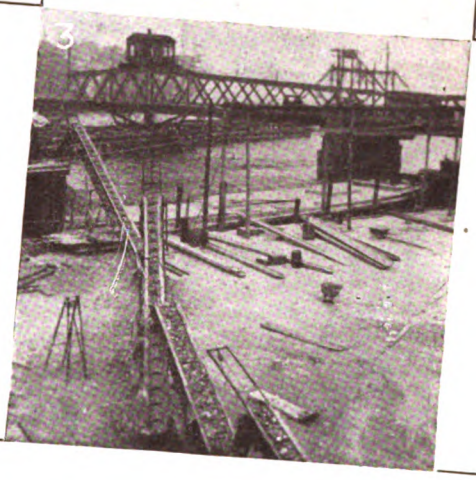
1—*REPLACING WHEELBARROWS, A Type U Loading brick from a kiln for the Onondaga Brick and Tile Co. at Onondaga, New York. It shortens wheelbarrow hauls in this case. In others, it does away entirely with wheelbarrow work.*



2—*UNLOADING CARS. A Barber-Greene Type U being used for "hauling out" coal by the Martin Lumber Company, Geneva, Illinois.*



U-Type-Barber-Greene Portable Conveyor, equipped with electric motor.



3—*LOADING FROM PILES. In this case, the material handled is oyster shell, and four Type U Barber-Greenes carry it from stock piles to barges. New Haven, Conn.*



4—*PIT WORK. A Type U handling gravel for Pierce and Piron, of Aurora, Ill.*

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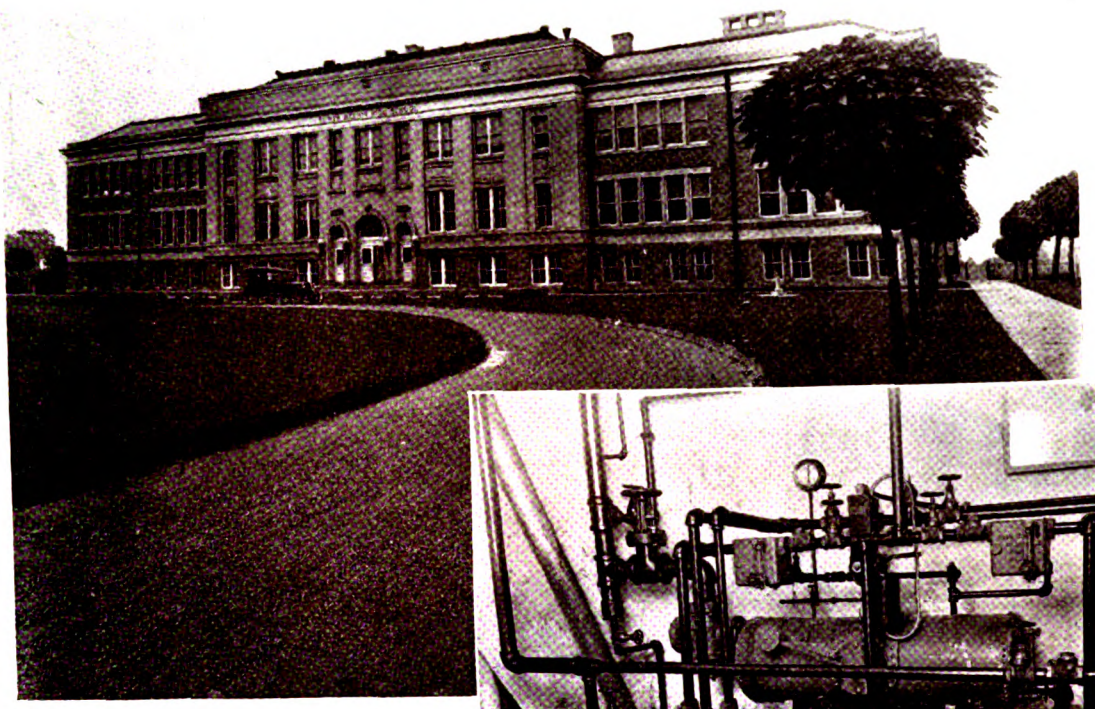
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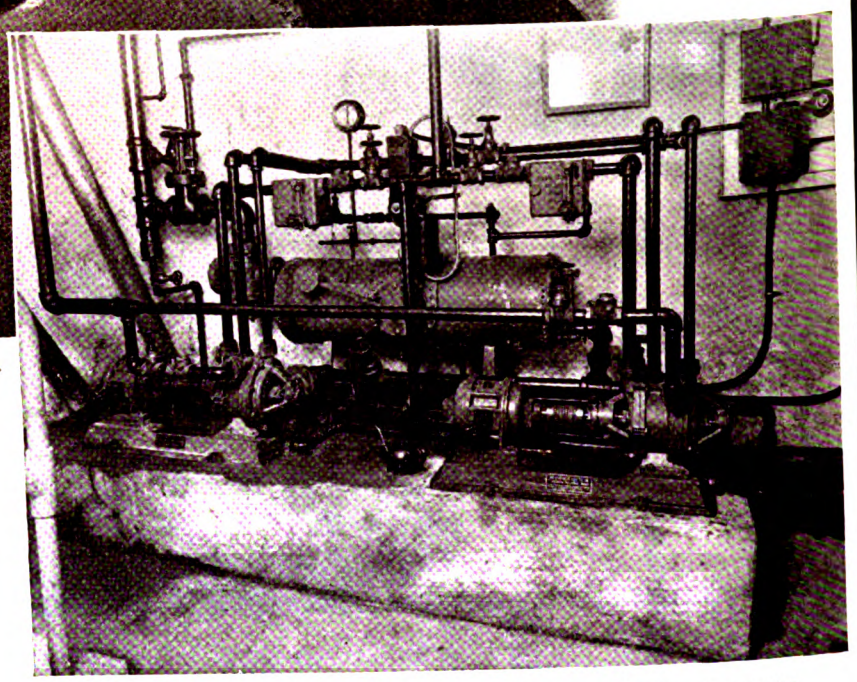
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What Is Ahead of Industry in 1924?

An Editorial Review and Forecast

WHAT is ahead of industry during the coming year?

Will 1924 be a year of industrial prosperity, with growth and advancement for the firms and individuals which shape their courses to the rising tide?

Or will it be an "off" year, the ebb tide of which will call into play the most skillful piloting and an unabating struggle to maintain positions and profits against its adverse current?

Some six months ago many of our professional prognosticators stated that we were inevitably headed for an immediate and serious period of depression. Since that time, and in spite of the damage necessarily done by the utterance of these predictions, business and industrial activity have continued their unabated way until today we are in a position second only to the boom peak of 1920. In car loadings, commodity prices, employment, wages and financial ability to pay its way, this country is in a sounder position today than it was when these pessimistic prophecies were broadcasted. Since then, Ford production has been boosted from eight to ten thousand cars per day, the United States Steel Corporation has declared an extra dividend on its common stock and the General Electric Company reports the astonishing and impressive total of fifty per cent. more in unfilled orders on its books than those of the year preceding. These cold, indisputable facts not only are of far more weight than all of the prognostications and curve projections of economic seers, but in addition they eloquently attest the fallibility of such prophecies and the danger of shaping one's course by them.

If the industrial executive is to look ahead intelligently into 1924, he must shape his own conclusions on the evidence of substantial facts instead of ingenious theories, and discard the fluctuations of the stock market as a barometer of industrial prosperity. The purpose of this editorial, therefore, is to lay before industrial executives not a prophecy nor a prediction, but a few plain fundamental facts from which it may help the responsible man to make his own predictions and his own plans for his own business.

* * *

As industry and business have progressed, as they have grown in volume and in specialization, their components have become simplified, but their entirety more complex. This is a truth that should be grasped by all who plan either the progress of individual industrial plants, or individual industrial careers. For it has a direct and heavy bearing upon the future.

Factors that were unthought of twenty years ago are daily growing in importance, becoming more simple in their elements and more complex in their entirety. Twenty years ago it apparently mattered little what sort of a building was available so long as it had sufficient space in it to contain the necessary machines. The manner of placing these machines, or their arrangement, was of secondary importance. It mattered little what sort of a roof covered the plant if it kept out most of the rain. Holes, broken in window panes, let in more light than the grime-incrusted glass, and furnished usually the sole means of ventilation. In winter, men left their machines at frequent intervals to warm numb hands at the "salamanders" or indoor bonfires. A floor was a floor whether of dirt or rough wood plank, attracting and receiving no attention so long as brute strength was capable of hauling, pushing, or prying loads over its uneven surface.

In the old days dirty, cluttered buildings were the rule, and clean, orderly buildings the exception. Broken windows were replaced once a year, in the Fall, at the time of the annual window cleaning. Paint was used generously upon the product, but sparingly upon the plant. Fire protection consisted in a possible insurance policy plus occasional half-filled water buckets. Friction loads of misaligned transmission shafting in many plants equalled or exceeded the power used in driving the producing machines. Millwrighting was an all-embracing title including the duties of power plant engineer, machine repair man, foundation builder, sewer excavator and construction boss. Today a dirty factory is a disgrace, the cluttered floor a sign of inefficiency, grimy windows and unpainted walls a sure indication of poor management. Keeping the plant fit for profits, from the standpoint of intelligent maintenance, requires its regular "daily dozen," its specific organization, and is as essential in the minds of modern, progressive executives as is keeping the body fit physically.

These conditions have led inexorably to a progressive and continuously increasing economic pressure for *more work per man.* This demand, which has led, in America, to the creation and improvement of vast quantities of automatic and labor-saving machinery, has been tremendously stimulated since the restriction of immigration. Demand, per capita, is increasing faster than the infiltration of new labor. All industries are beginning to feel the urge of this condition. The most successful industries will be those who best, and most quickly, respond to it. It is a condition that is here to stay for many years. It is the condition which will cause management its most acute difficulties and problems in 1924. It is the condition which will force inventive ingenuity to its limit, cause industrial executives to go over their manufacturing methods with a fine tooth comb, and thus prepare themselves for the most severe competition that they have yet had to face—not a competition in quantity production alone, not a competition in price alone, not a competition in sales methods alone, but a competition in searching out and installing the methods and machines that will result in more output per man, be he laborer, salesman, skilled mechanic, superintendent or chief executive. This, as we see it, is the foremost problem for 1924. No matter how good a year it may be for business in general, it will be a bad year for those who fail to follow this course of evolution. No matter how poor a business year it may be, it will be a good year for those in

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the vanguard of more output per man, and the real progress of these leaders must come from the close study and clear understanding of factors whose influence on costs and profits has hitherto been overlooked.

Merely following the time-worn road of the improvement of producing machines will not lead to this desired end. For the past two decades the active minds of American inventors have been centered upon the improvement and speeding-up of the individual machine, of replacing hand work by automaticity. Intensive concentration of so many minds upon a single subject has developed this phase of production to a point of impending saturation. Exceptions naturally will occur to this rule, but the big improvements in manufacturing economy in 1924 will lie outside of the improvement or speeding up of the producing machines. They will lie in directions hitherto thoroughly unexplored but which are destined in time to become main highways of efficiency.

* * *

For the past year our more progressive managers have been giving more and more attention to the matter of transportation. They have begun to discard the older idea of the primacy of the individual machine. They are centering their attention today upon the process, and not the individual operations, which have been perfected to a point beyond which refinements do not return proportionate dividends. They are finding a fertile field for improvement in the coördination of these operations with respect to the process and with respect to the flow of production. They are finding it necessary to make a careful study of mechanical handling—and that such studies pay big dividends! So important have we considered this new phase of management that during the past year we have published what is undoubtedly the most complete and extensive coverage of the subject of mechanical handling ever yet attempted. We shall continue to extend and improve this series during the coming year, and mention these facts at this time for the purpose of impressing upon our executive readers the importance that we attribute to this subject from the standpoint of managerial responsibility.

That there is a close relationship between the building and the production secured therefrom has been accepted for some time. How great this influence may be is just beginning to be realized. The remarkable development in transportation and mechanical handling has had substantial effect in bringing this about. It is beginning to be realized that productive machines, transportation machinery, buildings, and the human organization as well, are but parts in one big machine. These parts, to function at their maximum, must be properly adjusted to one another. A building can materially aid or materially hinder production. It can help to cut costs or to raise them. Its activities in either direction are long-lived, for a building is much more permanent in its nature than the equipment which it houses. Many of the factory buildings that we see today are actually hindering production and boosting costs—have been doing so ever since they were built—furnishing a permanent handicap to the manager in his struggle for a commensurate profit. Here is a subject about which surprisingly little has been written. It is a subject that executives must begin to study because, more and more, the handicap or the aid of the building will serve to tip the scales toward loss or profit.

* * *

As an aid to executives in their study of these problems, we are commencing in the January issue a series of articles on this important subject. This series will cover every phase of new construction and extensions and fixed equipment, and will show how the plans, the fixed equipment, the materials selected for the building and its construction directly affect profits.

While the profit-making or profit-losing possibilities begin with the planning and construction of an industrial building, they do not end there. Managers today are finding that properly conducted maintenance—keeping the plant fit for profits—frequently represents the difference between no dividends and full dividends on the capital stock. And it is much easier today in most plants to save, and thus make, a dollar through proper maintenance than it is to save and make an extra dollar through production. Mr. Ziegler, who is writing the series on Modern Maintenance of Plant and Equipment, now running in this magazine, brings out this point clearly, and also shows definite practical ways in which to corral the dollars that are now escaping through sheer neglect of maintenance.

* * *

There are certain outstanding manufacturing plants familiarity with which provides a liberal education in industrial methods. Of course it is impossible for a busy executive to take the months of time that would be required to first familiarize himself with the physical environment of such great plants and next analyze and absorb the lessons which their policies and their practice involve. It is with the purpose, therefore, of putting such visits within the reach of every executive that we are describing in 1924 the production problems of the General Electric Company. This is a logical sequence to the complete description of Ford Principles and Practice at River Rouge, which we have published in serial form during the past year. We believe that executives who follow this new series of industrial "travelogues," and who review the preceding one, will be materially helped in their own problems of 1924.

* * *

Nineteen twenty-four is before us. One year from now it will be a record of our own accomplishments and shortcomings, of our industrial successes or failures. No man can tell you what sort of a year it will be for you, for it will be the kind of a year that *you* make it. It is being ushered in under favorable conditions and circumstances. Earning and buying power is high, labor discontent is diminishing, American finances are in strong position and industry is getting away, for the race of 1924, with as good a start, if not better, than for any preceding twelvemonth. But the race will be a gruelling one. Competition will be strong and your own competitors will strive to make it stronger. A good track makes fast going for all horses. You will need to make every step count.

Your gross sales in 1924 may not be as large as they were in 1923. Yet your profits, in spite of this, may be larger. They *will* be larger, even on a diminished output, if you will extract from your operating costs the necessary dividend charges. And you can do this—not by speeding men or machines to the breaking point, not by cheapening the quality of your product, but by organizing to survey the yet unbeaten paths of maintenance, mechanical handling and better buildings.

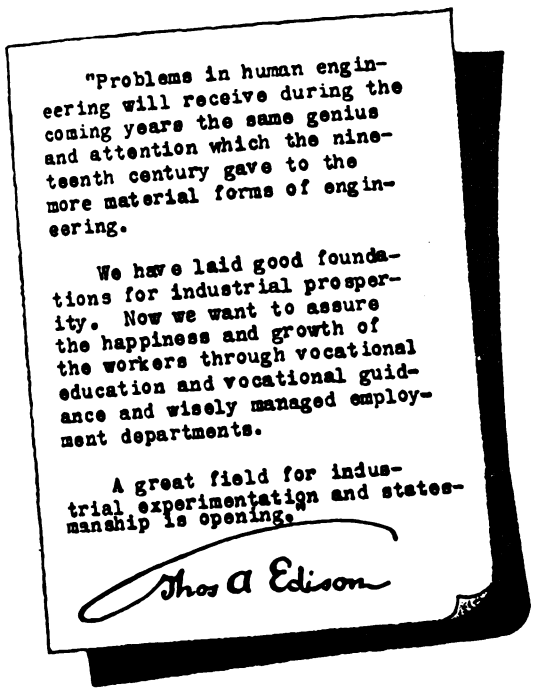
Finally, bear in mind these fundamental and obvious facts: The United States is the richest, the most powerful, and the foremost country in the world today. We are the center of World credit. We have the Gold Standard of values firmly established, and in the Federal Reserve Banking Act we have the most perfect banking system that has ever yet been devised by the genius of man.

Wages for all classes of skilled and unskilled labor have never before been so high in peace times—and they are certain to remain high, because of the restriction of immigration. This means an unprecedented buying power, and this immense volume of buying power, of one hundred and ten millions of enlightened, ambitious and prosperous Americans, is certain to keep all our legitimate manufacturing enterprises busy—if they be rightly managed!

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Is Industry a "Cold, Relentless" Machine?

A Prophecy —and Its Fulfillment



"Problems in human engineering will receive during the coming years the same genius and attention which the nineteenth century gave to the more material forms of engineering.

We have laid good foundations for industrial prosperity. Now we want to assure the happiness and growth of the workers through vocational education and vocational guidance and wisely managed employment departments.

A great field for industrial experimentation and statesmanship is opening.

Thos A Edison

The fac-simile reproduction of Mr. Edison's prophecy, at the left, appeared upon the cover of *Industrial Management* for January, 1917 — almost exactly seven years ago.

DOCTORS tell us that the development of the human body progresses apparently in seven-year periods. It would be stretching the point to attempt to draw a parallel between the development of the human physical structure and the development of that complex, man-made structure called industry. Nevertheless, the thought is called to mind by the recent statement of Mr. Charles M. Schwab, at a dinner given in his honor by the Engineers' Club at Philadelphia.

In January, 1917, INDUSTRIAL MANAGEMENT had the privilege of publishing a prophecy by Thomas A. Edison. So important was this prophecy considered, that, as evidence of hearty concurrence in the belief expressed, it was reproduced in fac-simile on the cover of that issue. That this belief was accurate is illustrated in a striking manner by the recent address of Mr. Schwab, from which we take the liberty of quoting as follows:

"In recent years," he said, "the engineers of America have directed their energies not alone toward great mechanical achievements, but toward the promotion of sound and amicable relations with labor.

"The people who labor are not and cannot be treated like dumb, driven cattle. They are above all else human beings, with feelings and sentiment, hopes and aspirations, and the fundamental problem of all industry is to so relate the human elements in the men who do the work, to the machines which they operate, that the men themselves shall first of all be happy and healthy, and that they shall thus be able to operate their machines with good spirit and efficiency.

"Few things in our American life are more wonderful than the great enterprise Henry Ford has developed. Mr. Ford has taught us all many new lessons in the handling of machinery and large scale production. But all of Mr. Ford's machinery and plans would have amounted to little had he not been able to build upon the foundation of satisfied and happy employees.

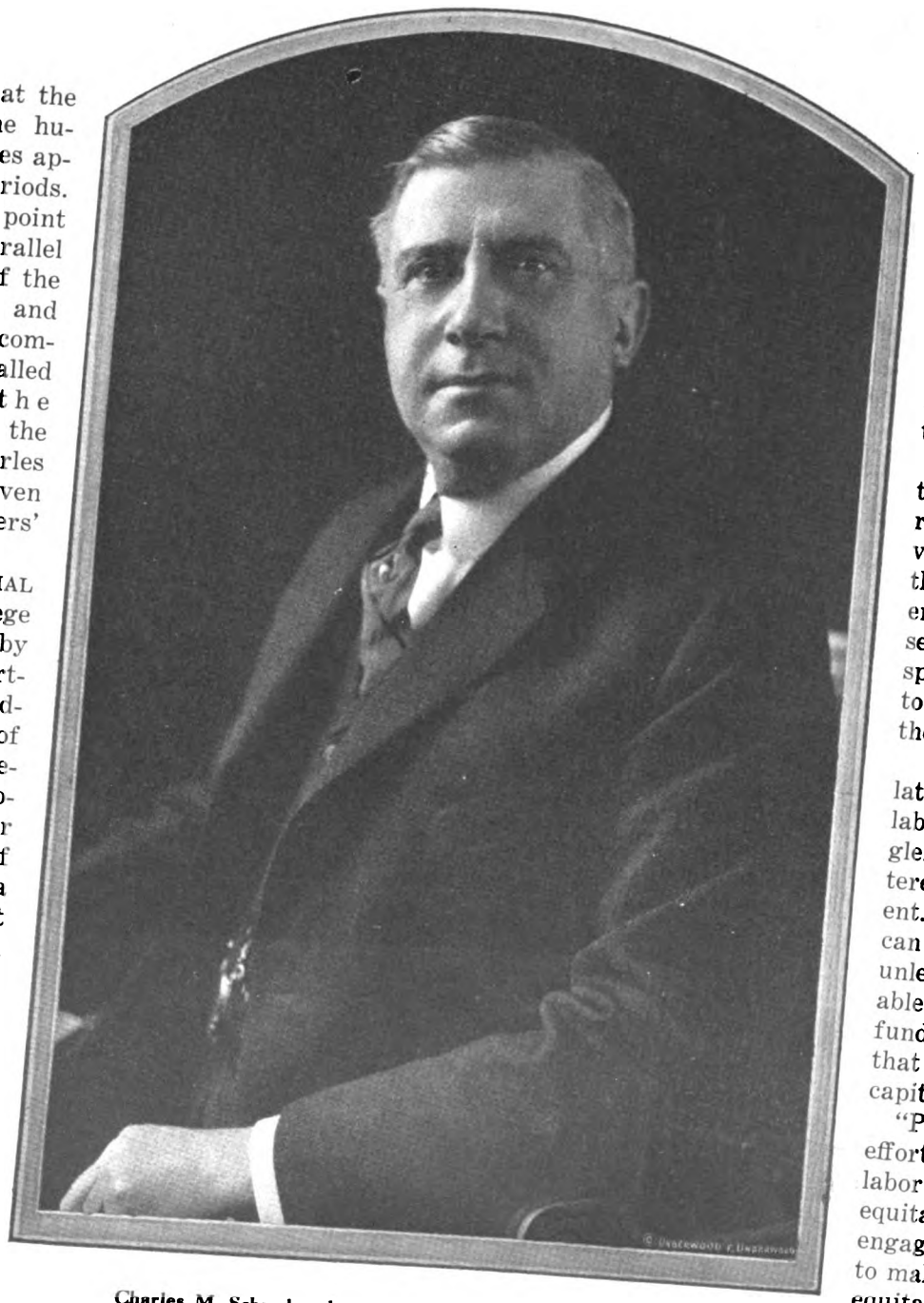
"When during the war I was placed at the head of the Emergency Fleet Corporation I realized that the need was not so much for machinery or more machinery, but it was to put spirit and power into the hearts, minds and muscles of the rank and file of the men who were doing the work. To build great plants, to erect huge machines, would take time, and the war would not wait. Yet to put new life and spirit into the men who were doing the job could be accomplished in a very short time.

"Hence I paid but little attention to the mechanical and material end of the business. I devoted my time to going among the men, both the superintendents and the rank and file, and seeking to promote in them a spirit which would enable them to get miraculous results with the material at their command.

"Many people conceive the relationship between capital and labor as one of stress and struggle. They talk as though the interests of the two were different. My experience is that there can be no success in industry unless there is at least a measurable appreciation of what is so fundamentally true, namely, that the interests of labor and capital are identical.

"Perhaps the division of the effort of industry as between labor and capital is not always equitable, but the effort of all engaged in industry should be to make that division even more equitable. And that is the direction which human engineering is taking today, an effort in

(*Continued on page 77*)



Charles M. Schwab, whose acknowledged position of leadership in present-day industry lends significance to his views, as expressed in a recent speech before the Engineers' Club in Philadelphia.

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Keeping the Wheels Turning

Maintenance and the Millwright

By William G. Ziegler

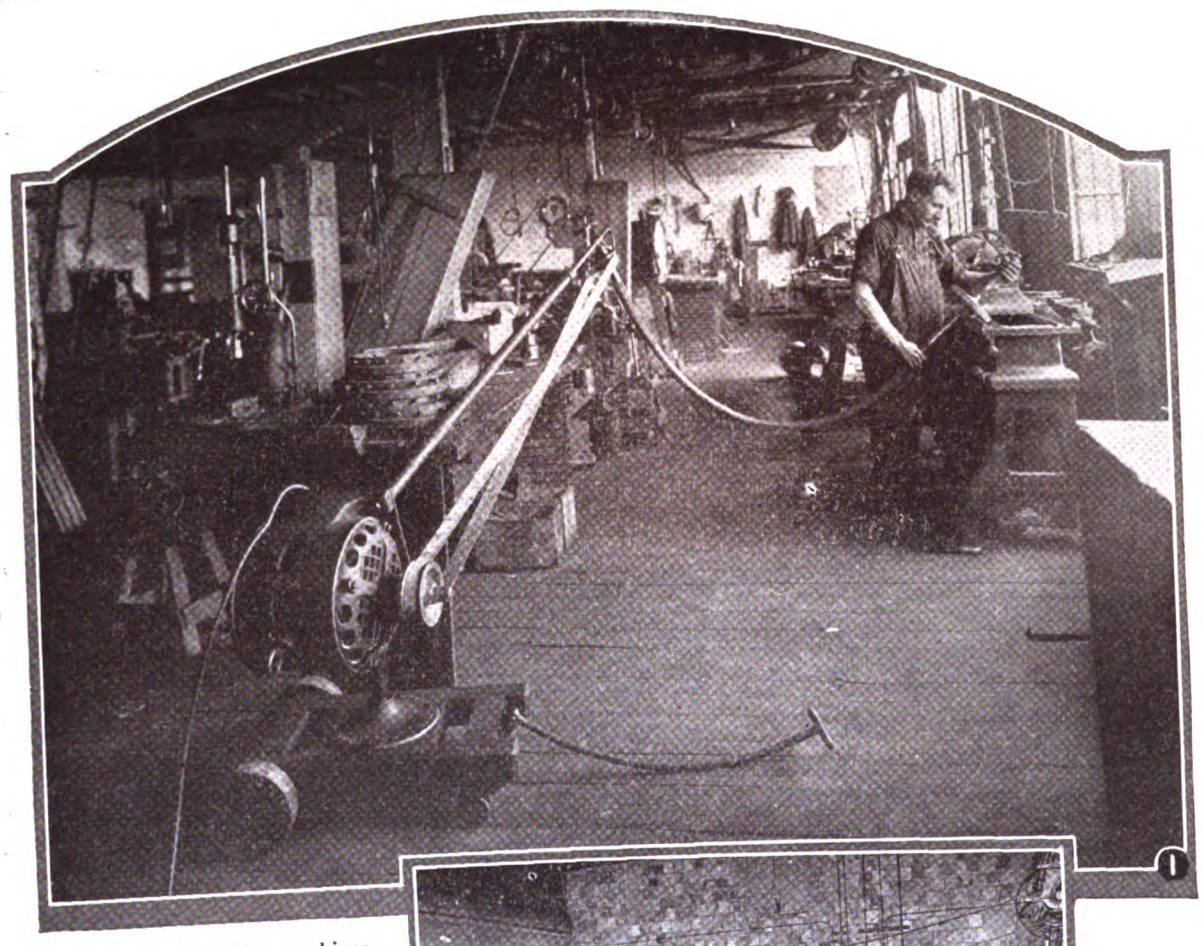


Fig. 1. Portable machines have a profitable use in plant maintenance. They save moving heavy machines to the repair department.

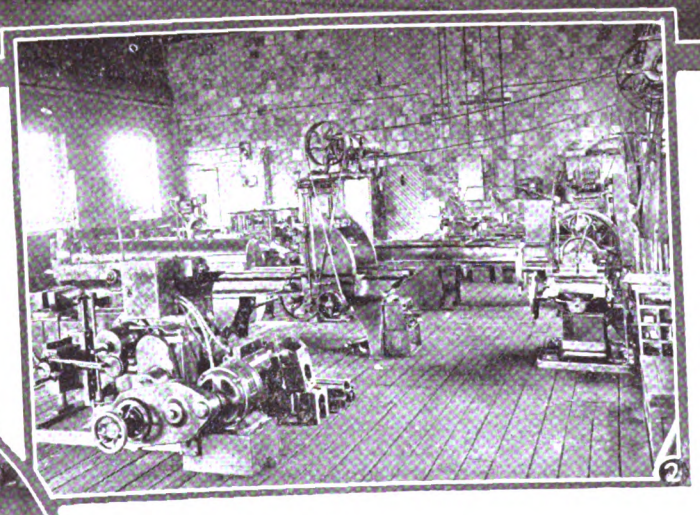
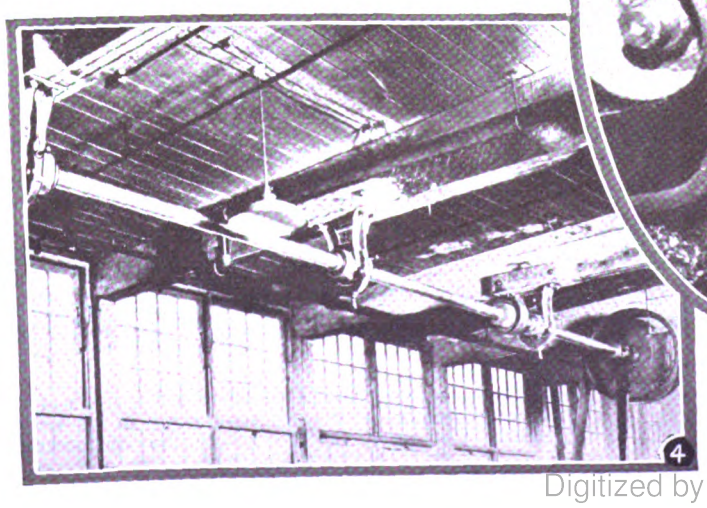
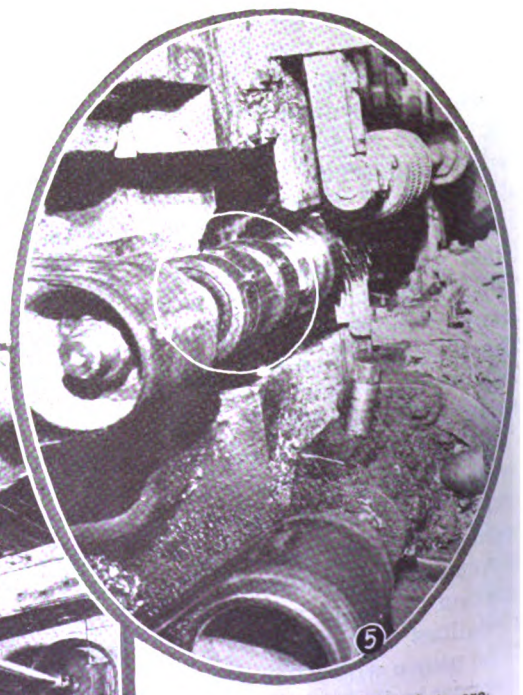


Fig. 2. Maintenance headquarters are often represented by a completely equipped repair shop. Above is an electrically driven one.



Fig. 3. Transmission losses eat up dividends in many plants. The use of roller bearings on line shafts helps to recover these dividends.





Figs. 4 and 5. Ball bearings are capable enemies of friction and may be used even where dirt and dust prevail.

When a breakdown in any part of the transmission equipment occurs it is the millwright gang who get on the job in a hurry to fix up the break. It may only be a bearing in the countershaft of a single machine and thus can be fixed without much loss of time or production. But if it is only a small break in an important main line or elevator or crane, it may hold up the operation of an entire department. In this article, various points are brought out to show how many of the, or called, breakdown jobs are really preventable if an earnest effort is made to take care of little items that don't amount to much in themselves, but add up if not taken care of.

Some plants have very severe service on their transmission equipment; in other words, they are running on an overload or peak all the time. In these plants breakdowns are to be expected, and a so-called flying squadron of the best millwrights in the plant should be ready to get onto a job at a few minutes' notice. It is not necessary to have these men loafing around

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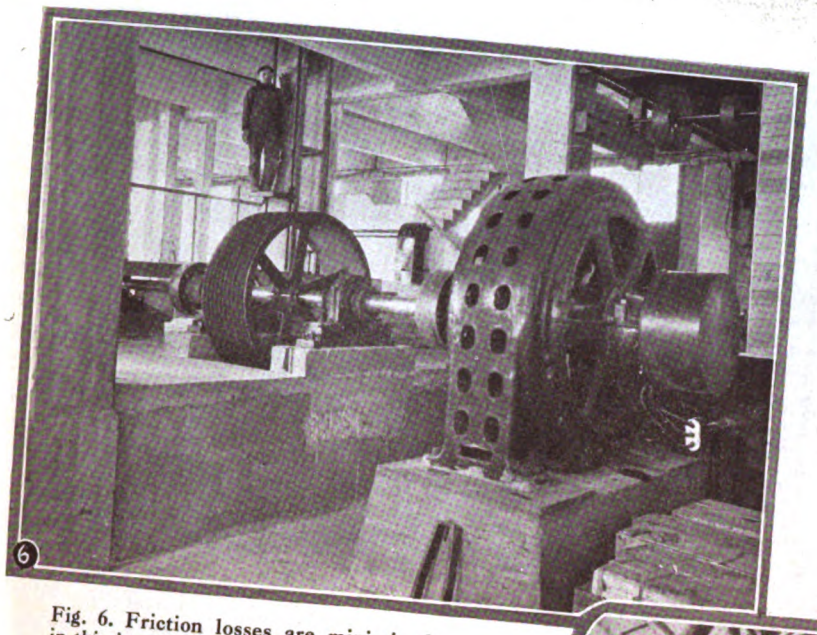


Fig. 6. Friction losses are minimized in this installation by means of six-inch self-aligning ball bearing pillow blocks.

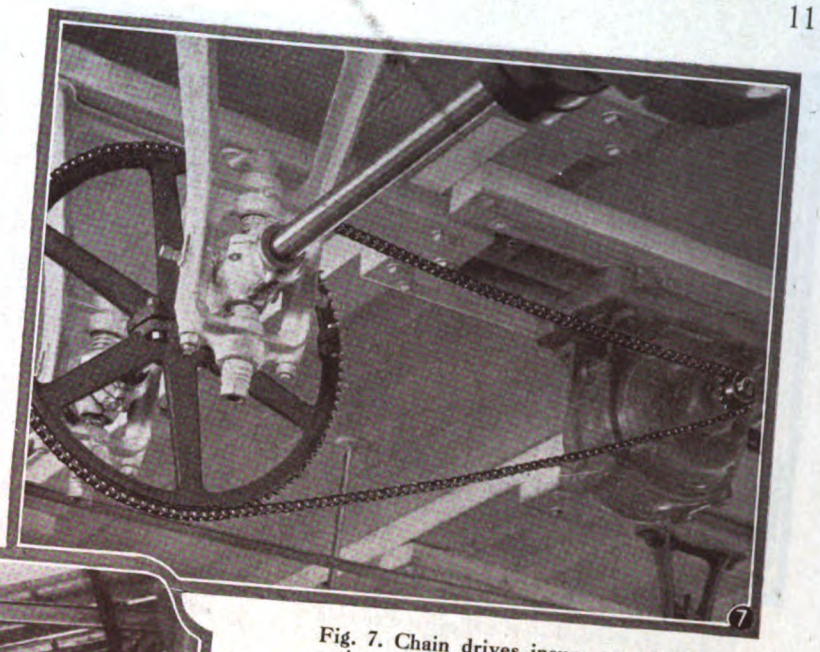


Fig. 7. Chain drives insure a positive action without slippage and require proper care and lubrication.



Fig. 8. Short belt centers and high drive ratios do not necessarily mean inefficiency. But they call for special treatment as indicated above.

waiting for something to happen; they can be used on small jobs from which they can be called at any time.

The item of friction losses looms large in the power bill of any plant, and it is therefore important that every effort possible should be made to cut them down. A loss of 20 per cent. of power consumed is not unusual in the average plant where this item has not been looked into. Friction is a greedy consumer of power, especially if wearing surfaces are not well lubricated. Where plain bearings are used throughout the plant, a high grade lubricating oil should be used in order to cut down as much friction loss as possible in that way. The installation of ball or roller bearings is sometimes advisable. This can be decided on when conditions are known to be bad and a sufficient saving in power can be shown to offset the investment. Good grease is very important on ball and roller bearings to prevent rust and retain lubricating efficiency over a long period.

Another preventable cause of friction is tight belts. They spring the shaft out of line and wear the bearings. All belts should be just tight enough to deliver the power they are designed to deliver. Sometimes the cause of belt slippage is not on account of the tightness of the belt, but is caused by having pulleys too small. Then it is necessary to increase the size of both the driving and driven pulleys to get enough surface for the belt to cling to. Try to equalize the belt pull on both sides of the main line so that bearings won't get worn on one side. This point brings up the arrangement of machines.

In planning the grouping of machines, the aim should be to cut down the number of belts and countershafts required. It is often possible to put in a single jackshaft, driven by one belt from the main line, to drive several machines directly under the jackshaft. It is a cardinal rule that the power be delivered to the lineshaft at the middle of its length, and with motor drives it is usually convenient to do this. When a main lineshaft is driven from one end, that end of the shaft is subjected to much more severe torsional strains than it would be subjected to if it was driven at the middle. It also tends to throw the shaft out of line and this of course causes friction. Correct speeds of belts and machines are another possible way to reduce the loss of power. In order to be sure of speeds being

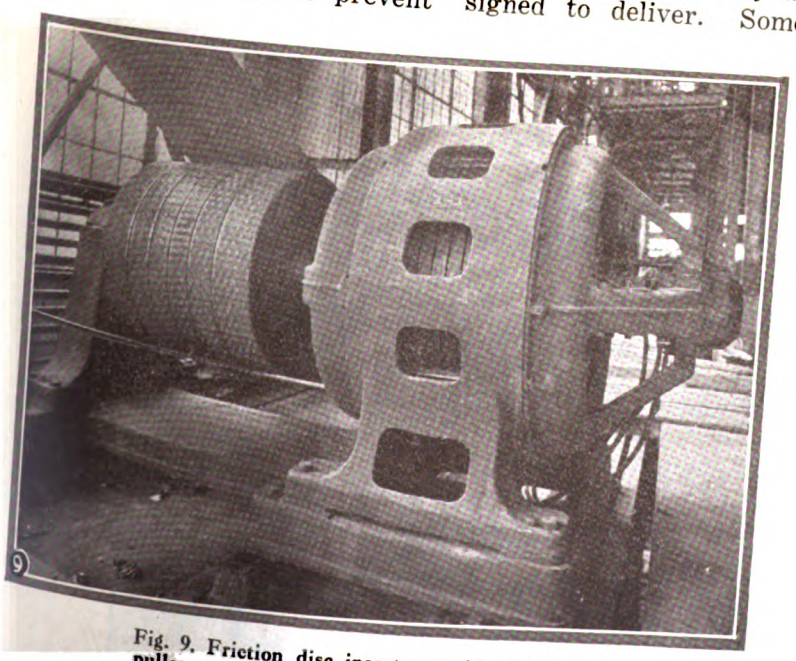


Fig. 9. Friction disc inserts on this driving pulley guard against slippage, loss of power and profits.

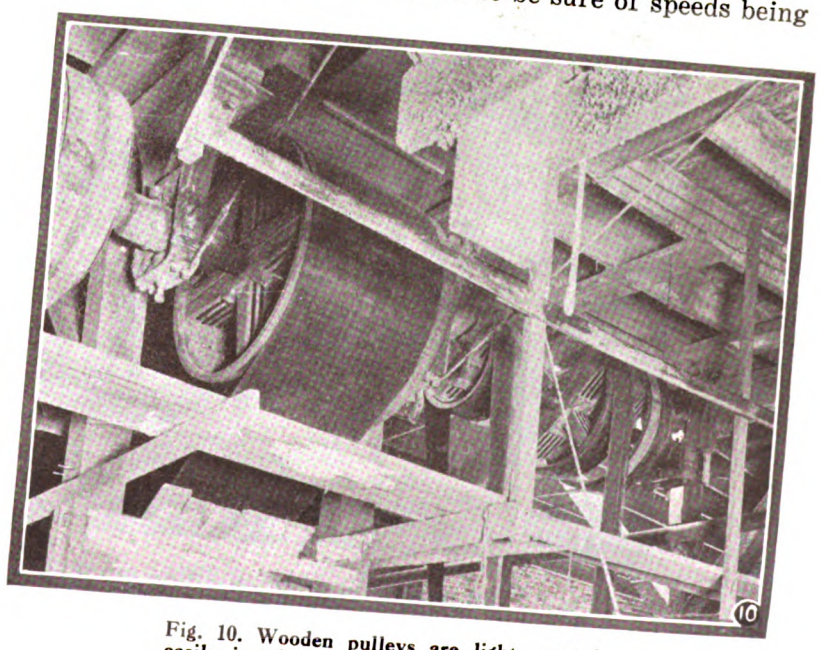


Fig. 10. Wooden pulleys are light, rugged, easily installed and well adapted for their specific purposes.

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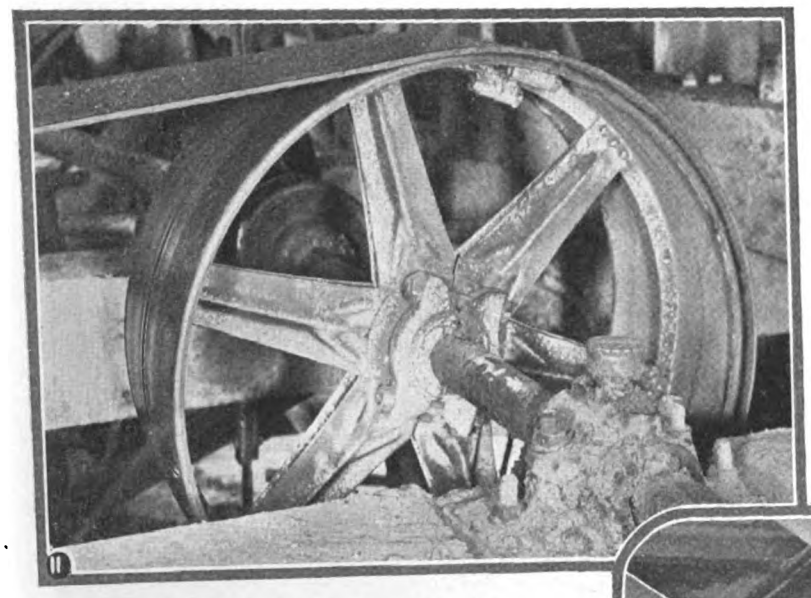


Fig. 11. Pressed steel pulleys are coming more and more into use. This shows a pressed steel split pulley installed under arduous driving conditions.

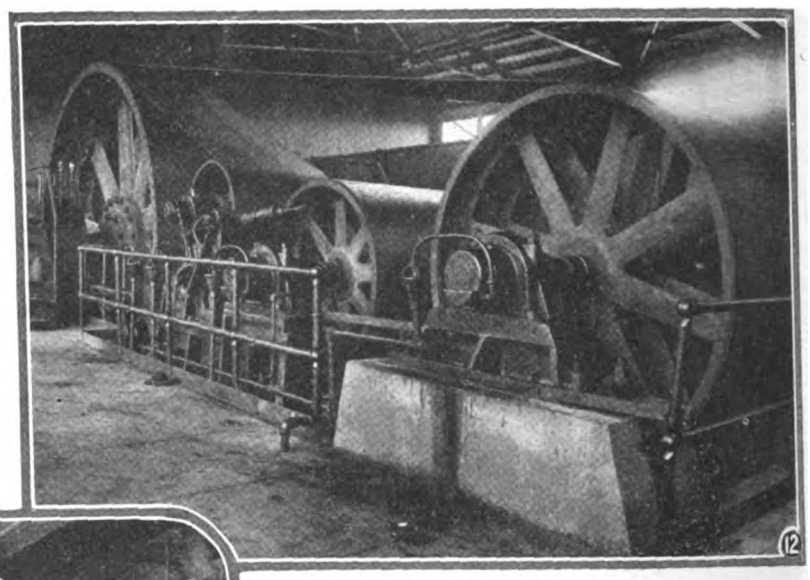


Fig. 12. On this Morgan drive in a steel mill we have an illustration of two belts on the same pulley.

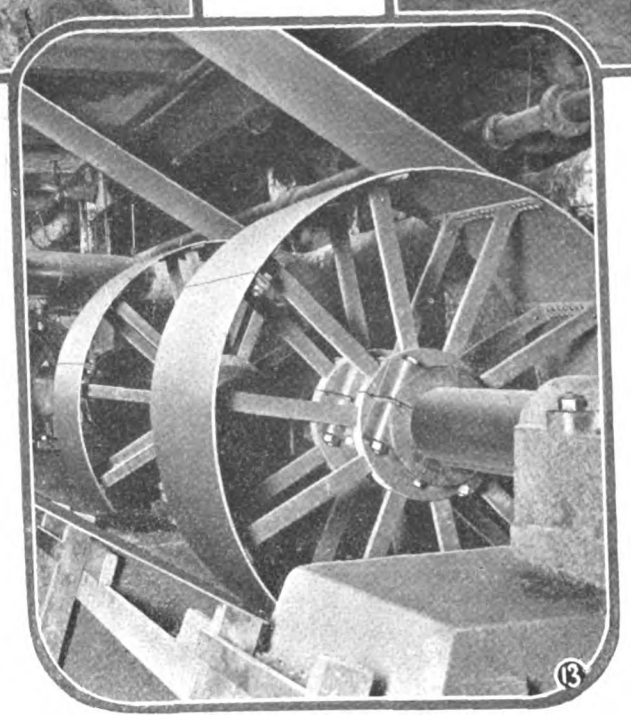
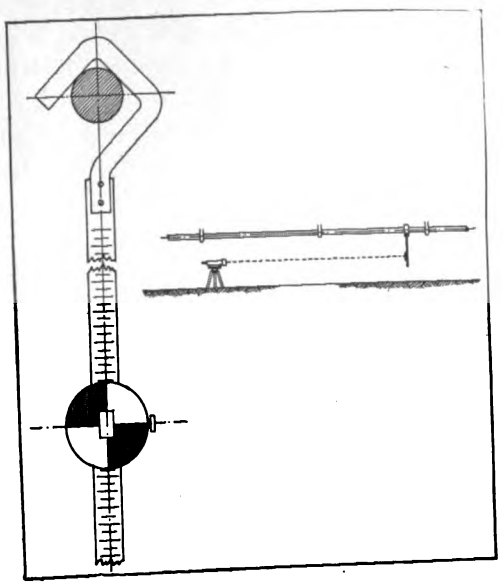


Fig. 13. A case of severe drive service is illustrated here. These pulleys are seven feet in diameter and five feet face, and transmit 850 horsepower at 183 r.p.m. The belts are of stitched rubber.



Where considerable shaft aligning must be done the transit and target method saves time and money. The sketch speaks for itself.

Fig. 14. Each belt (below) is 107 ft. long. Their record of close to two million miles travel — twenty-four-hour service since 1917—speaks well both for the belts and for the men who installed and maintain them.

correct, a good speed indicator, or better yet, a good hand tachometer should be used to check up.

Main lines can be lined up in several different ways. A piano wire held by a clamp about six inches left or right of the shaft is a good method for sidewise lining. Turnbuckles are needed to tighten it good and tight. The wire is apt to sag a little and should not be used for very long shafts for up and down lining. A good method for accurate lining is to use a transit or builder's level and plumbob and leveling rod. The transit should be set up directly beneath one end of the shaft to be lined, and by using a plumbob and a leveling rod held upside down against the bottom of the shaft, it is possible to line up accurately and quickly. If much of this work is to be done, the leveling rod can be provided with a hook so formed as to allow the rod to hang plumb.

In a steel frame building, hangers are sometimes bolted directly to the beams or trusses and it is then advisable to insert lead washers under the feet of

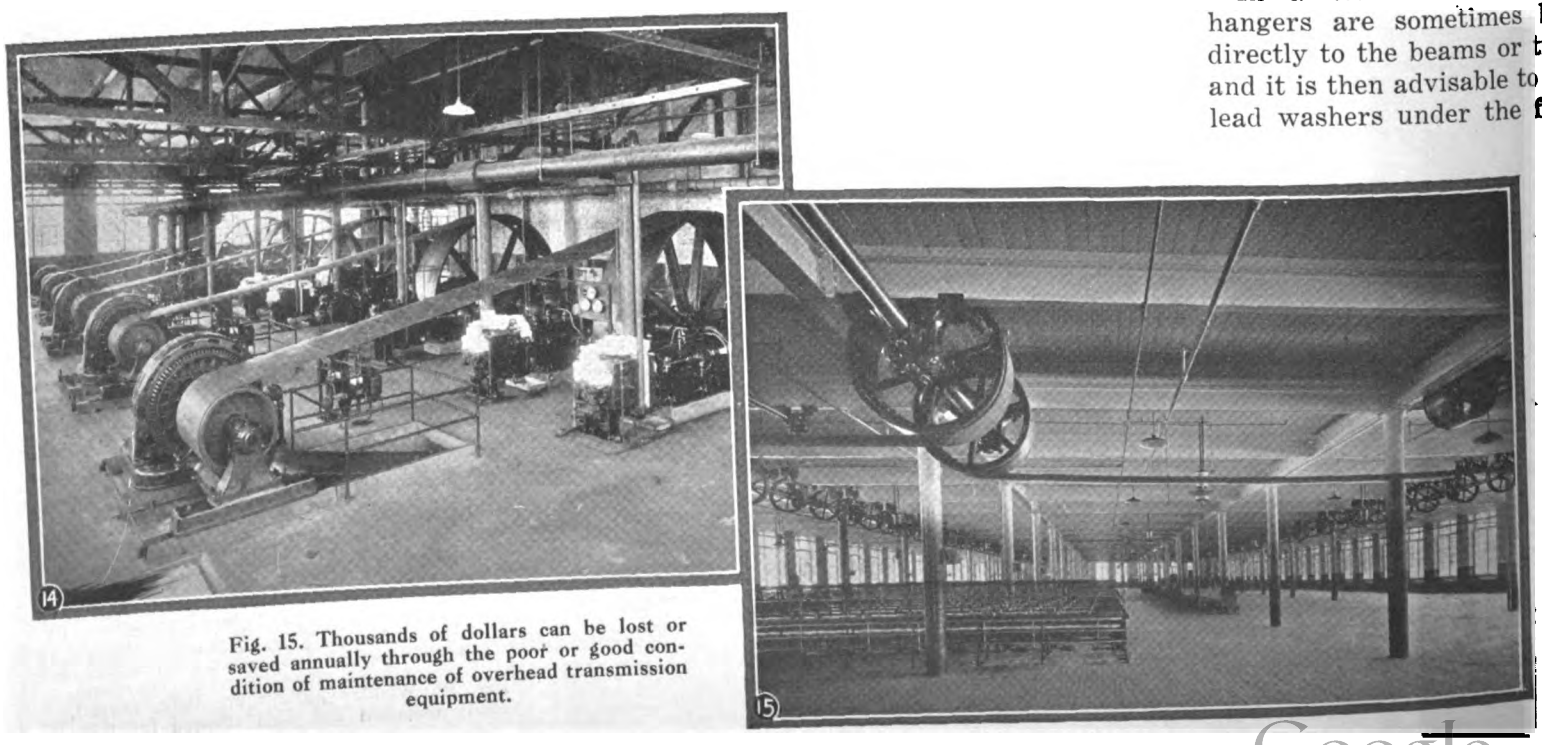
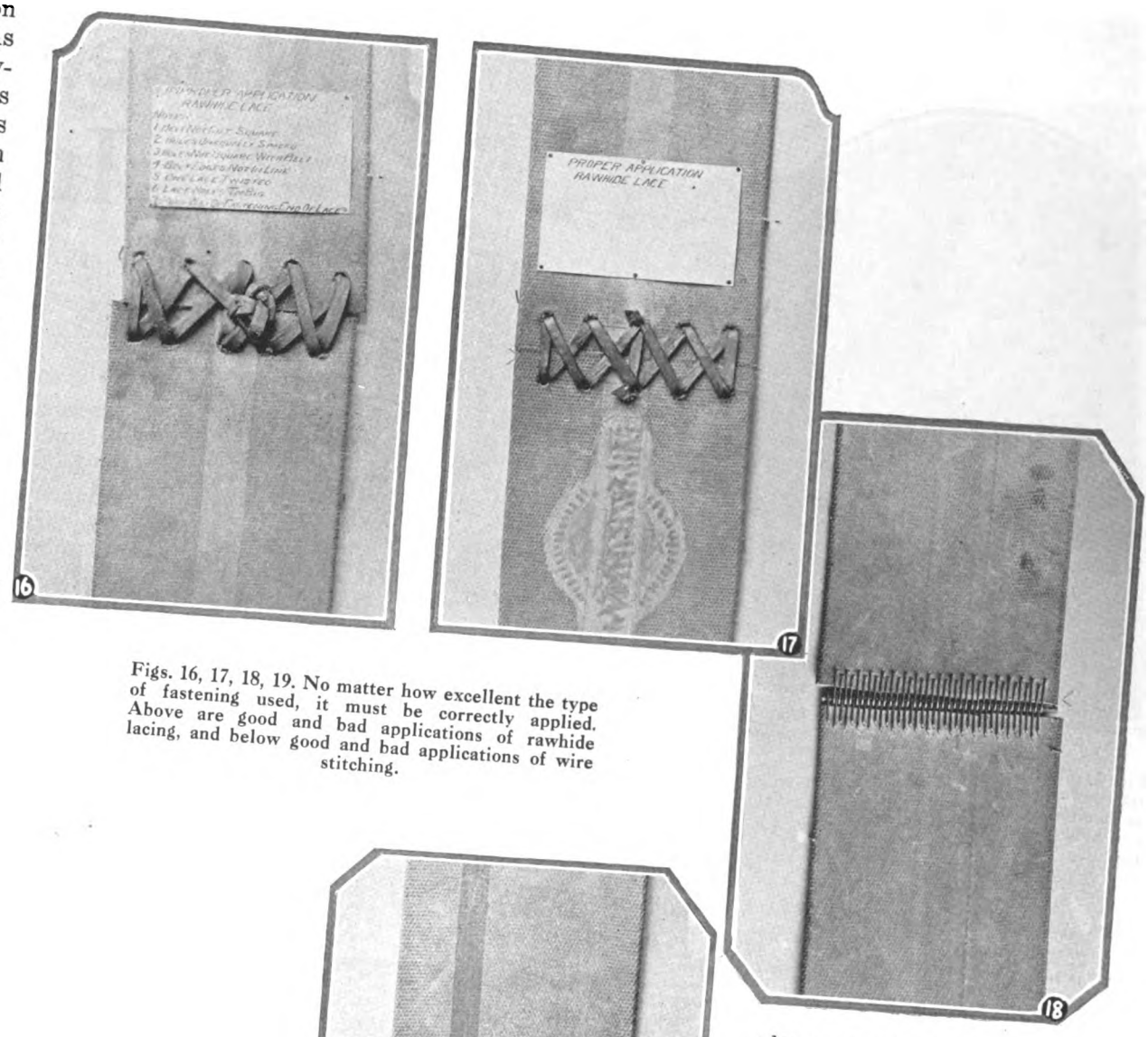


Fig. 15. Thousands of dollars can be lost or saved annually through the poor or good condition of maintenance of overhead transmission equipment.

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the hangers so that vibration can't work the bolts loose. As an additional precaution, however, lock washers or lock nuts should be used. These bolts should be tightened up when they are inspected, which should be at least once a year. The boxes in the lineshaft hangers will work loose even though there are locknuts on the adjusting screws, and it is therefore necessary to inspect and tighten these occasionally. If the motor drive is near the center, thrust collars can best be put at the hangers either side of the motor.

In case a whole department is to be moved or entirely rearranged, the subject of the most economical main line speed should be thoroughly investigated. Several items are in favor of high speed main line shafts, viz.: smaller diameter and therefore cheaper shafting and smaller diameter pulleys. To offset these savings, the use of ball or roller bearing hangers, with a rather high first cost, is generally necessary. However, if the savings in friction loss, over a long period of time, are taken into account, it will usually be found that ball or roller bearings will pay for all main lines. Another point in favor of these types of bearings is the reduction in cost of maintenance because one packing of grease will usually last for three to six months, whereas regular ring oiled bearings should be oiled every few days. The importance of correct oiling of all main lines and countershafts cannot be stressed too much. Oiling and greasing should be under the direct supervision of the millwright foreman so that he alone can be held responsible for the condition of the transmission equipment from the motor belt to the spindle of every machine in the plant. The electrician has the job of keeping the motor pulleys turning, and the machine repair department has the job of keeping the machines working properly, but in between these two points the millwrights have the mighty important job of keeping the wheels turning day in and day out.



Figs. 16, 17, 18, 19. No matter how excellent the type of fastening used, it must be correctly applied. Above are good and bad applications of rawhide lacing, and below good and bad applications of wire stitching.

Fig. 20. Proper belt joining is good for the life of the belt, as is indicated in this case, where the belt has had many years of severe service and is still carrying its power.

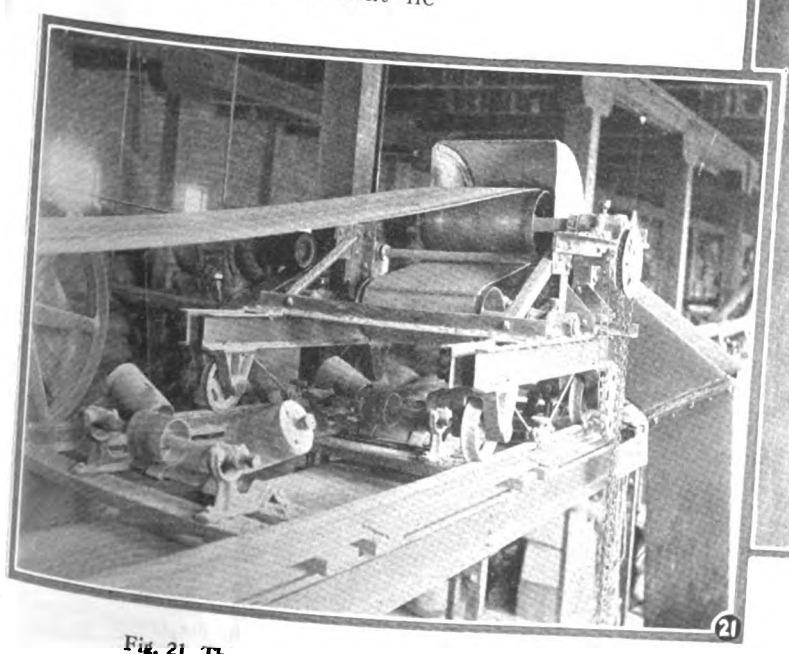


Fig. 21. The problem of joining belts applies as critically to conveyor belts as to power transmission belts. Here is an example of a grain elevator conveyor which delivers 4,000 bushels per hour. Note the fastening.

The small gear or rotary pumps which are used on many machines to pump oil or a solution into the work, can be taken care of by the machine repair department or by the millwrights. However, a great deal of the trouble with these pumps is belt trouble, and it is therefore expedient to let the millwrights take care of them. If convenient, the machine repair department can issue to the millwrights a few spare pumps which can be used to replace any pumps that have to be taken off. This method never holds up a machine more than a few minutes.

There are two general types of countershafts, the tight and loose pulley and the friction clutch types. The bearings on loose pulleys, if plain bearings,

(Continued on page 51)

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Research and Industrial

By L. A.

Engineer, Research Laboratory,

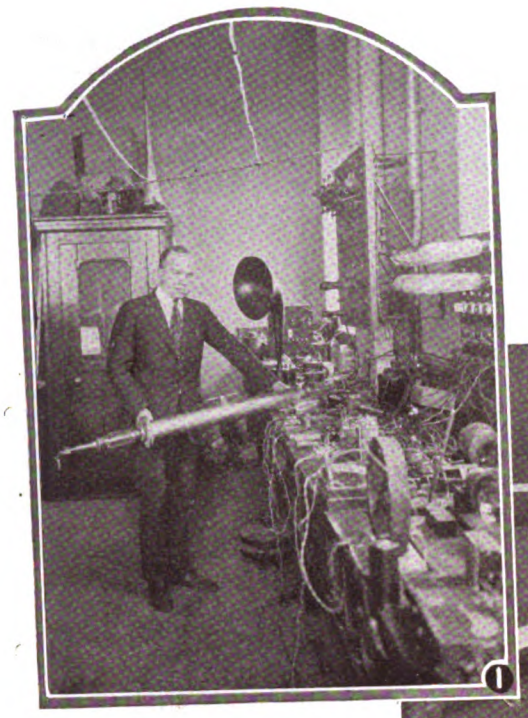


Fig. 1. This 1,000 KW vacuum tube is "big brother" of the one so familiar to radio enthusiasts, and holds some fascinating possibilities for power conversion.



Fig. 2. The young lady at the right is taking photometric readings, in the research laboratory.

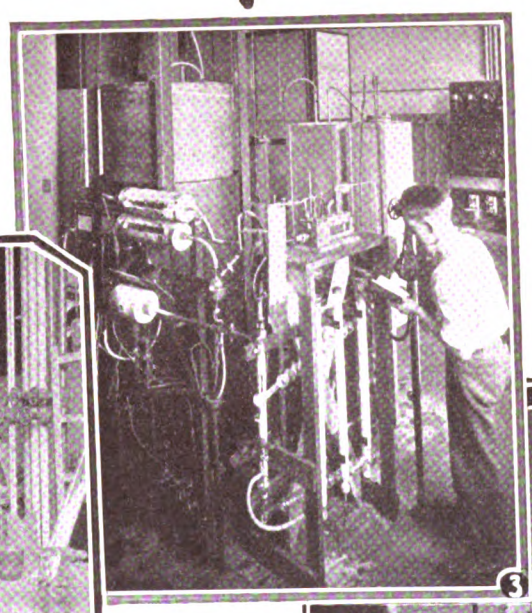


Fig. 4. Below—The modern version of the Venetian art: the glassblowers' room in the research laboratory.





Fig. 5. At the left—Rolling tungsten sheet, in the laboratory. This is one of the things which, a generation ago, was among the impossibilities.

Fig. 3. At the left—here Argon, a rare gas whose value is of comparatively recent discovery, is being purified.



Fig. 6. Above is a general view of one of the rooms in the research laboratory. It would be hard to estimate the actual dollars-and-cents value of this organization.

To write something worth reading about research is more difficult today than it was twenty or even ten years ago. Then industrial research was a novelty. The large industrial laboratories in the United States, though growing in number, were still few, and in England there were practically none. Some splendid research work was in progress in university and private laboratories in England but in America there was very little.

Then came the war, and almost at once the world learned to what an extent it had become dependent on the industrial laboratories of Germany. Dyestuffs, medicines, chemical reagents, optical glass, instruments, laboratory supplies, magnesium, special alloys, potash, were among the supplies cut off by the strangle hold of the British fleet. In Allied and neutral countries alike chemists and physicists were called from universities into the service of government and of industry to seek to develop the art of producing the equal of or substitutes for the German materials no longer available. Such hastily organized research was always costly and usually inefficient. Meanwhile the German laboratories were quickly and effectively engaged in producing substitutes for the materials denied to Germany by the British blockade, substitutes without which the war could not have lasted as it did, and in developing new and terrible weapons of offense.

So, among the lessons which Germany taught the world was the value of the industrial labor-

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the Modern Laboratory

HAWKINS

General Electric Company

atory. In England and in the United States alike the firm resolve was made never again to permit a possibly hostile state to obtain such a monopolistic eminence in the industrial applications of science. Even during the war, plans were formulated for ambitious and permanent research programs, and no time was lost after the armistice in putting those programs into effect.

Every large industrial corporation organized its own research laboratory. National Research Councils were formed to promote coöperative research by those industries in which the companies engaged could not afford individual laboratories, and to try to coördinate for better efficiency the work of the existing laboratories. Universities hastened to establish research departments to train the men demanded by this new scientific growth. Even the American Federation of Labor, realizing that the high wages and shorter hours won during the war could be retained in peace only through increased efficiency in production, passed resolutions and memorialized Congress urging national support of industrial research. Papers, magazines, and books have been filled with dissertations on the value of research, and countless addresses have been made in furtherance of its extension, until now there is danger that the word research may become as obnoxious through repetition as the word coöperation became during the war. And it is a real danger.

Also, there are many specific

(*Continued on page 69*)

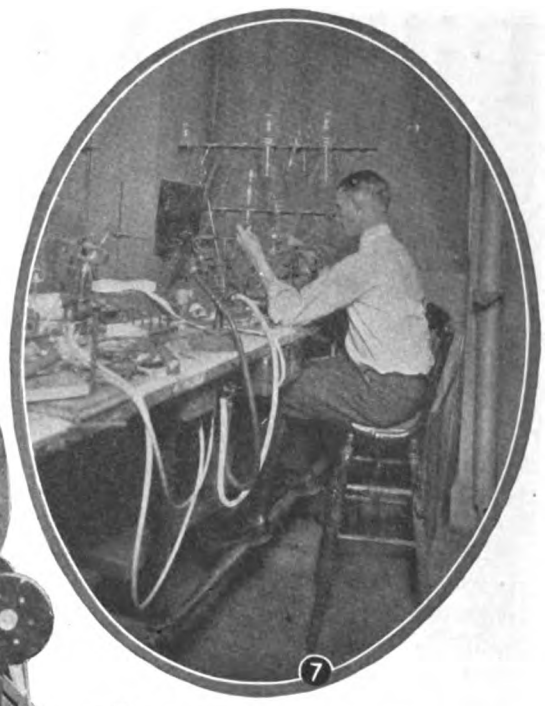


Fig. 7. Above—The glassblower is an indispensable adjunct to the research work.

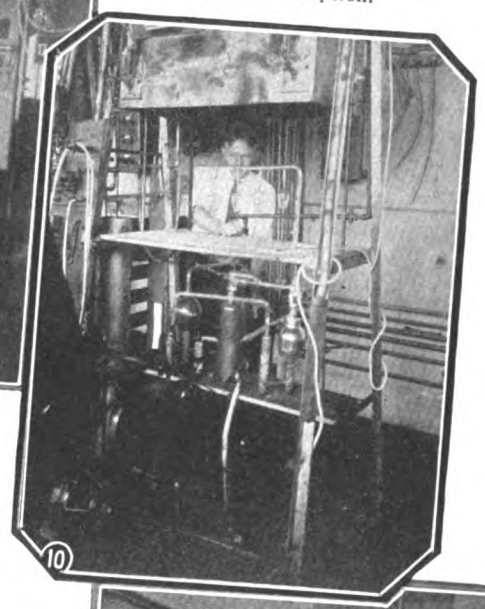


Fig. 8. At the left—Dr. Coolidge, with one of the portable X-ray machines. The picture is somehow reminiscent of visits to the dentist.



Fig. 9. At the right—Here our ubiquitous companion, the radiotron, is being tested.

Fig. 10. Below—Exhausting the air, preliminary to sealing and attaching the bases of the now familiar radiotrons used in broadcast reception.



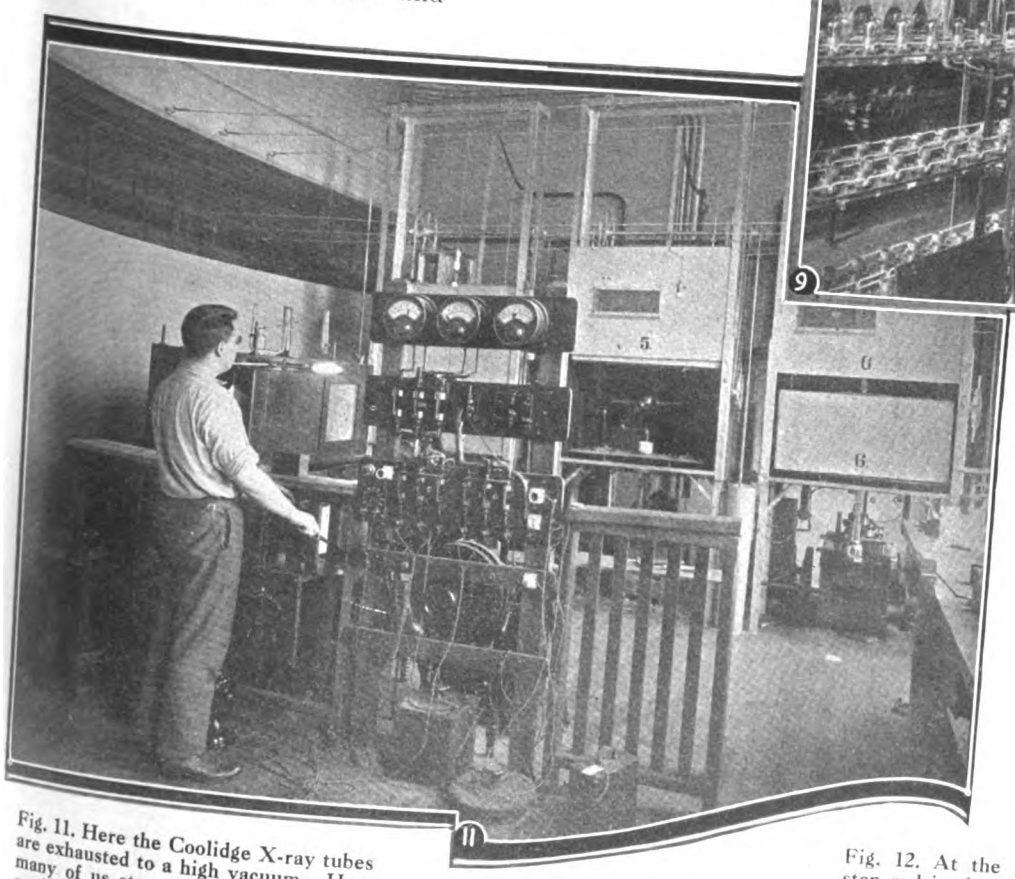
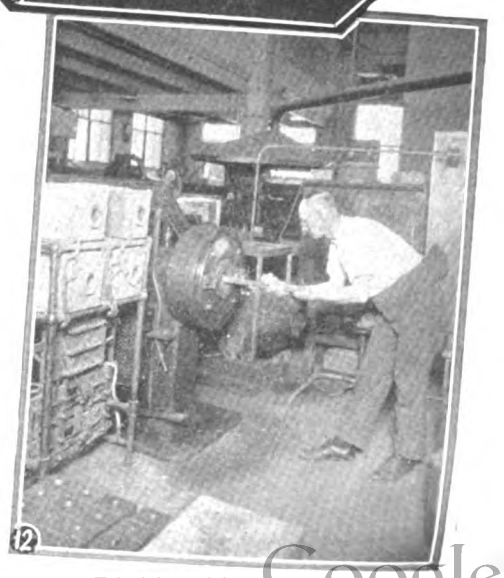


Fig. 11. Here the Coolidge X-ray tubes are exhausted to a high vacuum. How many of us stop to think of what the modern X-ray apparatus means to our general health?

Fig. 12. At the right—Swaging tungsten rod in the laboratory. It is tungsten which has divided our electric light bills by four.



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Piling Up Goods—and Profits

Making Full Use of Overhead Storage Space

By Matthew W. Potts

PREVIOUS articles by the writer appearing in this magazine have laid great stress on the common labor shortage, and continually pointed out how mechanical power will provide plenty of common labor cheaply and quickly. While materials handling equipment has been given the misnomer "Labor Saving Equipment" it is now being found by its more extensive use that greater savings are being made in money, time and space than by the actual elimination of labor. For this reason, the more universal term now being employed is Materials Handling Equipment.

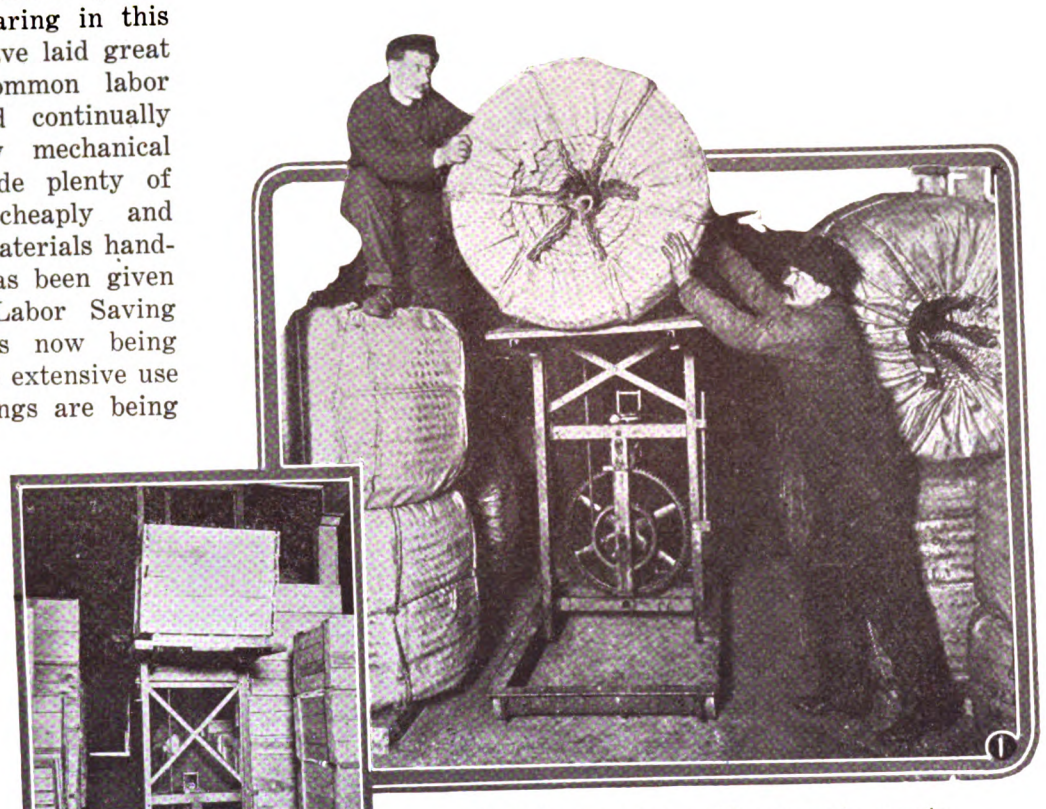


Fig. 1. By providing machines to assist men in piling, the value of this storage space was increased 200 per cent.

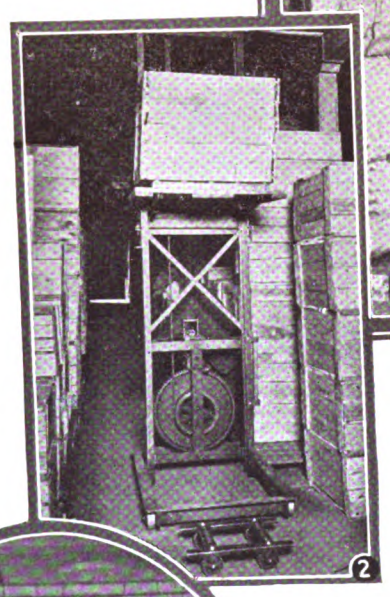


Fig. 2. Narrow aisles and high piles reduce cost of storage if mechanical methods of piling are employed.

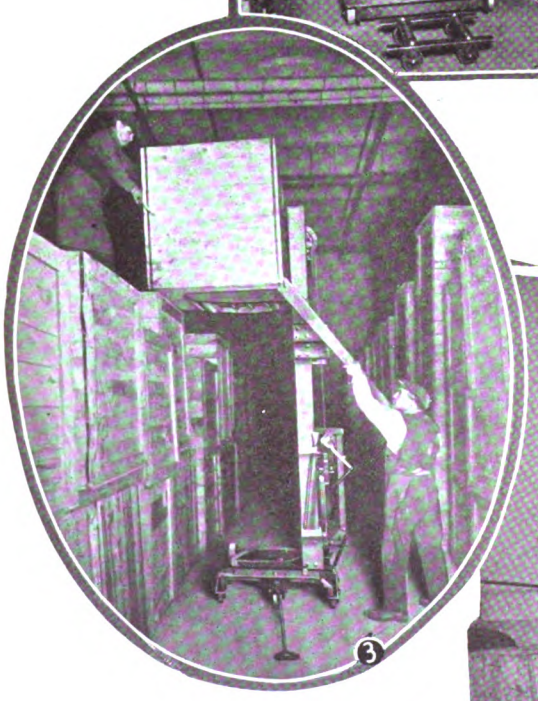


Fig. 3. In removing heavy cases from the machine platform, the operator can assist the piler as shown.

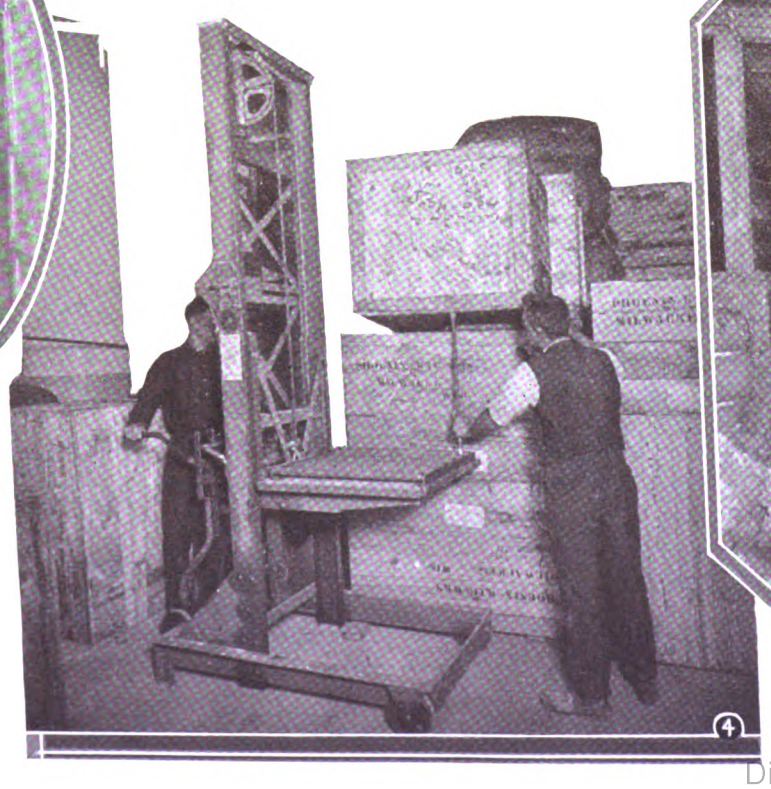


Fig. 4. Method of raising case with machine to remove or insert pipe roller, which facilitates handling, if heavy goods are being piled.



Fig. 5. Piling bulky and loose bales of materials is costly unless done by machine equipment.

Many instances have been illustrated showing the large money savings effected by the installation of this equipment, and it can readily be seen from these same illustrations that the machine equipment performs the operation quicker than manual labor, thus saving time; and one or two illustrations have been shown where the installation of this equipment has saved valuable floor space in manufacturing departments.

It is not only in the manufacturing or process departments that floor space is valuable. The various plant warehouses and storerooms now present great sources of extravagance in space. Many plants provide special buildings for storing their products. By making a survey, it will be found that all of this floor space is not used to the best advantage. The buildings are generally single story with plenty of overhead

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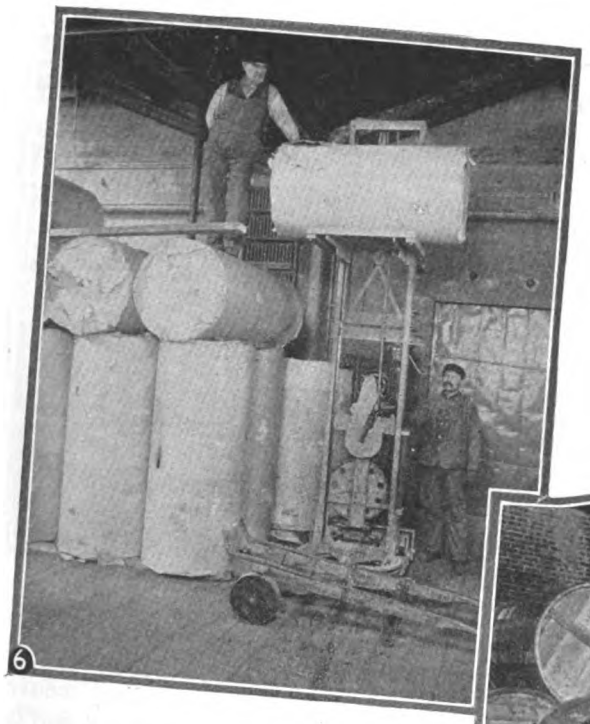


Fig. 6. Hand methods of piling in this case would be impossible, but the electric machine and two men accomplish this task with ease.



Fig. 8. In extremely high piling, or for piling between roof trusses, a telescoping machine saves considerable time and space.



Fig. 7. Hogsheads of tobacco, because of their bulk, used to be piled only one or two high. In modern tobacco warehouses they are piled in tiers four high.

space, or they are multiple story buildings, with ten or twelve foot head room.

It is true that frequently the allowable floor loads will not permit the high piling of materials, but more often the waste of valuable overhead space is due to the cost of piling materials higher than a man can reach, or to the inconvenience and bulkiness of the packages to be piled. In the piling and storage of materials in industry, despite the number of successful installations of materials handling equipment on these operations, there is still a large percentage of the work being done by old hand methods. Manufacturers do not seem to realize that every time a laborer handles their boxes, bags, bales, barrels, etc., his labor cost adds just so much to the indirect expense as an item in the cost of the goods. In fact, the goods go into the market burdened with an expense that competitive goods handled by machinery do not have to carry.

Such non-productive expense is unnecessary, however, for the development of piling machines and better storage methods has reduced piling costs, saving from 50 to 75 per cent. over hand methods by reducing the number of men required, and at the same time speeding up the operation, and doing the same amount of work in from one-third to one-half the time. These machines, furthermore, make all the storage space available, thus making it possible to store goods to the highest points allowable, even to the very ceiling, and to pile the packages flush with the aisles.

Machine equipment will generally enable one man to lift with ease packages that would tax the strength of four to eight men, and this reducing of the

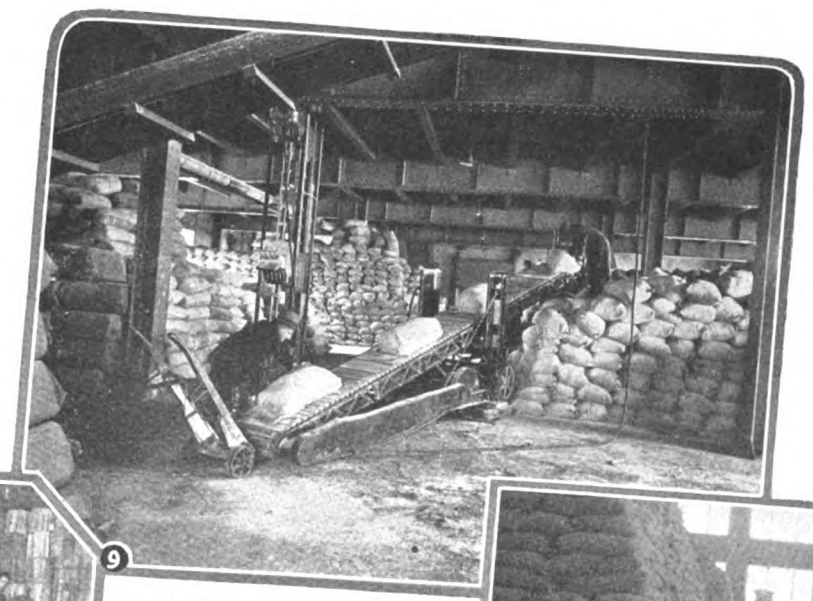


Fig. 9. Piling bags by hand is expensive, with portable conveyors costs are reduced.



Fig. 11. Bundles of barrel staves provide an insecure footing for men when piling. The conveyor eliminates accident hazard.

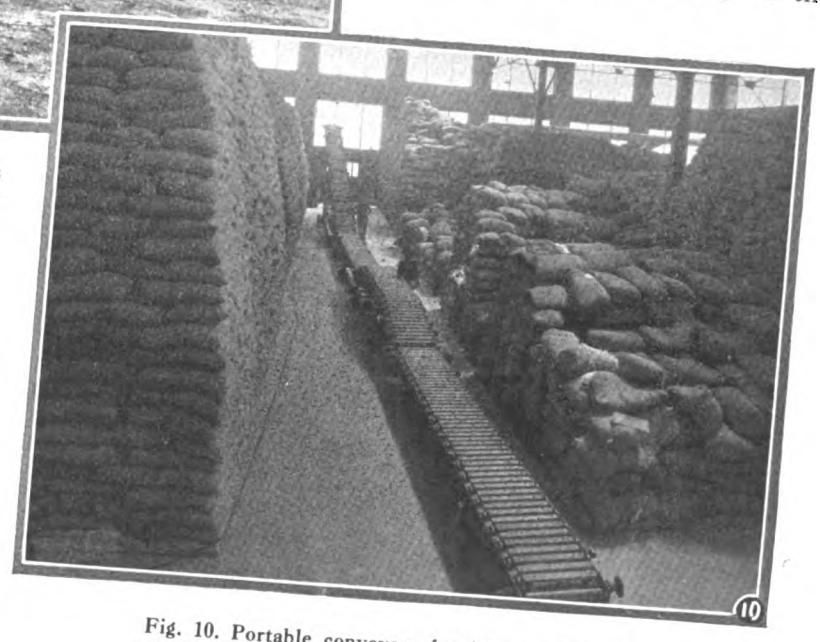


Fig. 10. Portable conveyors furnish a continuous stream of bags to the top of the pile. Additional sections can be added as shown.

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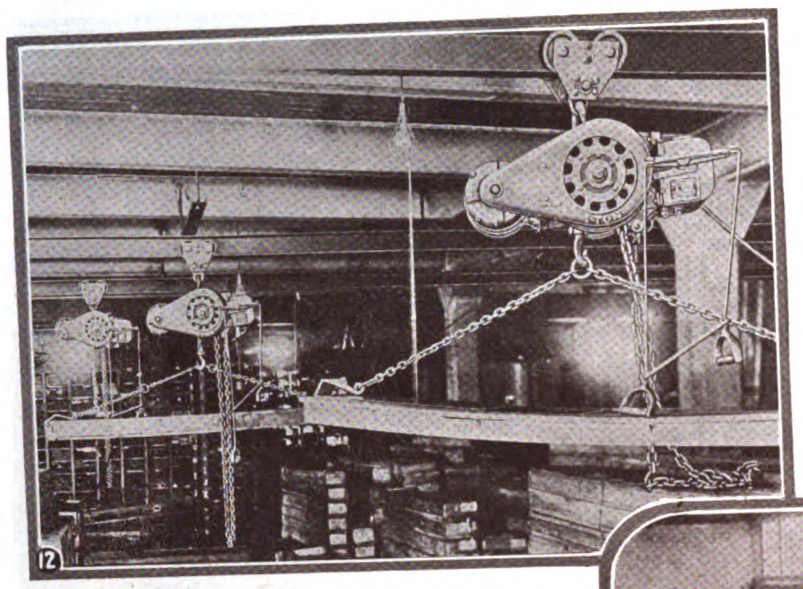


Fig. 12. A monorail and electric hoist provides the best method of handling large sheet metal.



Fig. 13. Barrels of dry materials can be piled in straight lines as shown.



Fig. 14. Materials stored by this method waste valuable overhead space.



Fig. 15. Installation of racks permit liquids in wooden barrels or metal drums to be safely stored, and utilize all overhead space.

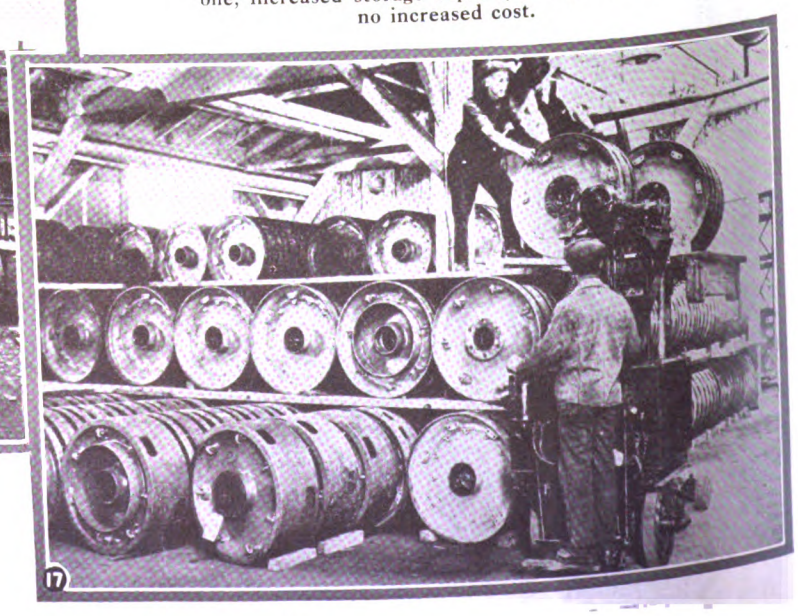
working force is an insurance against labor shortage and labor turnover. Materials handling equipment makes the laborious work of piling so easy that the best workers stay, because they realize the advantage of working with a machine, instead of doing the heavy work by hand. When laborers are piling goods, there is considerable waste time waiting for trucks to bring materials to the pile. It is seldom that there is a continuous stream being delivered to the piling gang, and even if this condition could be brought about, it would be necessary every few minutes to give the men a rest.

Unused space and excessive labor costs in the storage warehouses, both for raw materials and finished products, are eating into the profits of a number of industries. In order to see quickly the savings that can be made by the use of some form of materials handling equipment, we will look at figure 1, where a hand-operated portable ele-



Fig. 16. Racks can be erected before the building, or afterwards to fit conditions.

Fig. 17. Tiering heavy motor truck wheel castings (700 lbs. each) three tiers high instead of one, increased storage capacity 200 per cent., at no increased cost.



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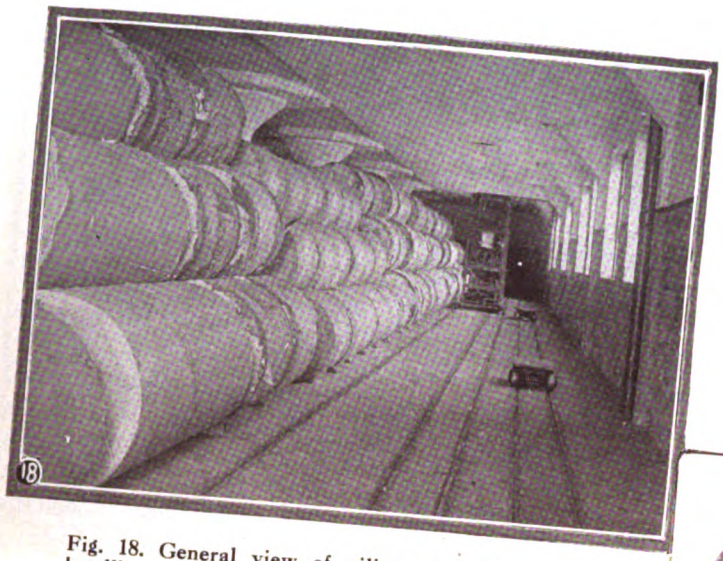


Fig. 18. General view of piling machine and handling methods in paper storage room of large newspaper establishment.

vator is being used to raise coils of rope, weighing over 700 pounds each. Previous to the purchase of the equipment, this rope was never stored over one high, since it required four men to lift the coils up to the second tier, thus making the piling cost prohibitive. Now, through the use of the machine illustrated, the coils are piled three high, thus utilizing all available head room and increasing the storage capacity of warehouse space by 200 per cent.

The ability of this machine equipment to work in narrow aisles and to pile the goods as high as desired, makes all space available, and every inch earns its pro rata of the cost of the entire space. Figure 2 shows how one man can handle case goods to a height of over eight feet, without any other assistance. Figure 3 shows how, if the packages are heavy, or extremely bulky, the machine operator can assist the piler in removing the package from the

(*Continued on page 29*)



Fig. 19. Close up view of piling machines in Fig. 18 and method of loading and unloading same.

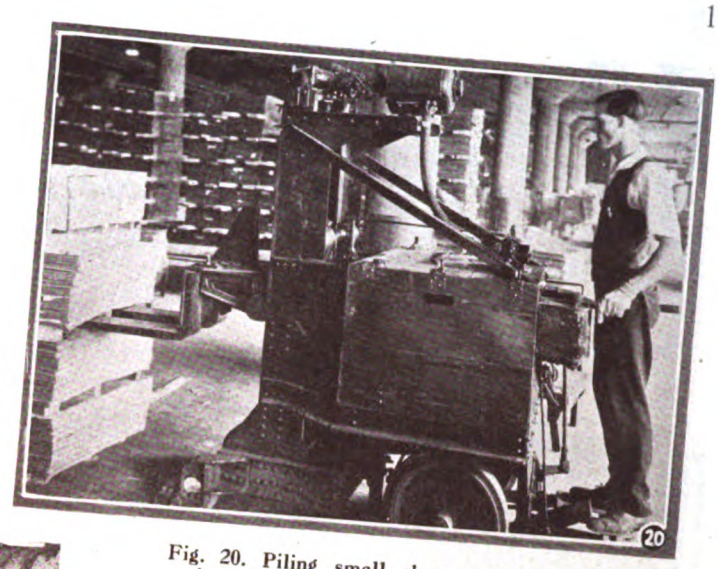


Fig. 20. Piling small sheet metal can be cheaply handled by special tiering truck.

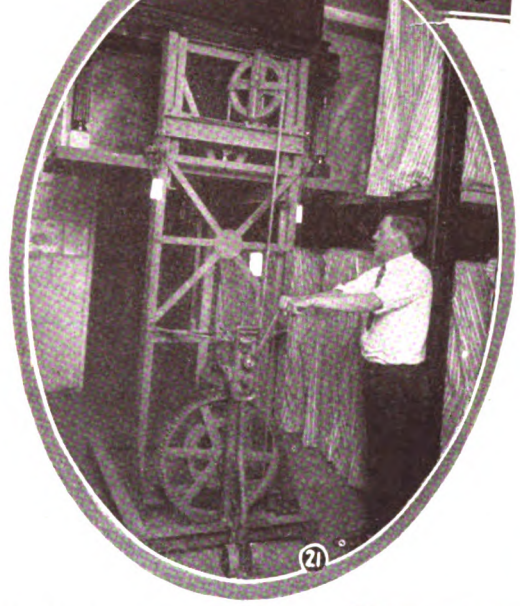


Fig. 21. Piano storage in this factory was increased 100 per cent. by building a mezzanine platform.



Fig. 22. Wasteful method of storing machine parts in process, causing enormous losses in money, time and space.

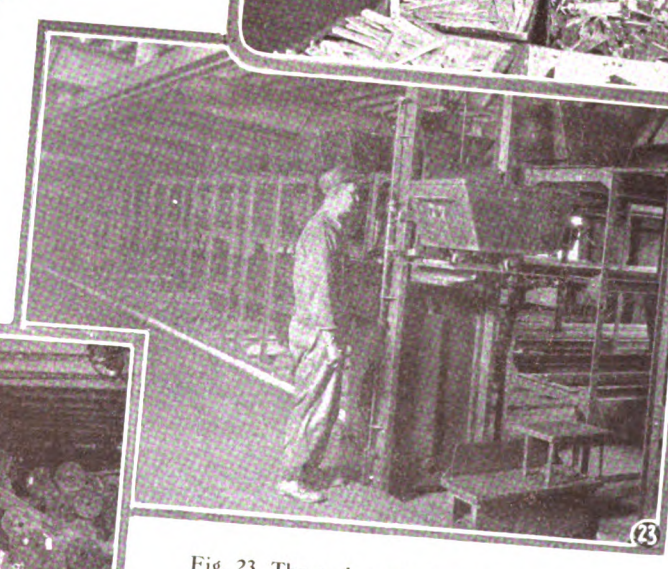


Fig. 23. The rack method now employed for storing materials, shown in Fig. 22, quickly paid for itself.



Fig. 24. This system of racks for storing warp beams has reduced handling costs, loss due to damage, and also saved time.

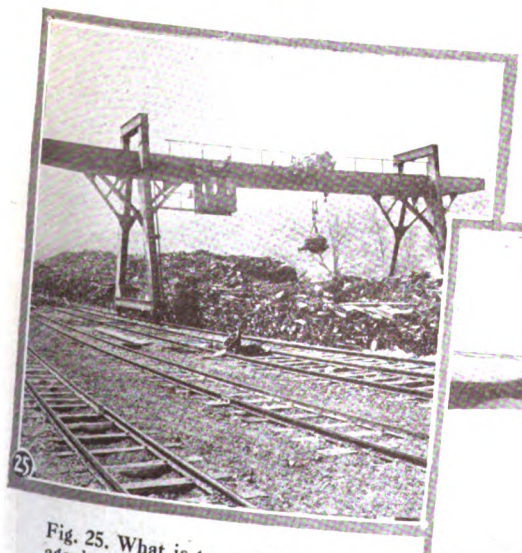


Fig. 25. What is true of inside storage is also true of overhead space and outside storage, where the pile should also be high.

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What Do You Pay for Steam?

Checking Costs and Losses in the Boiler Room

By James T. Beard, 2nd

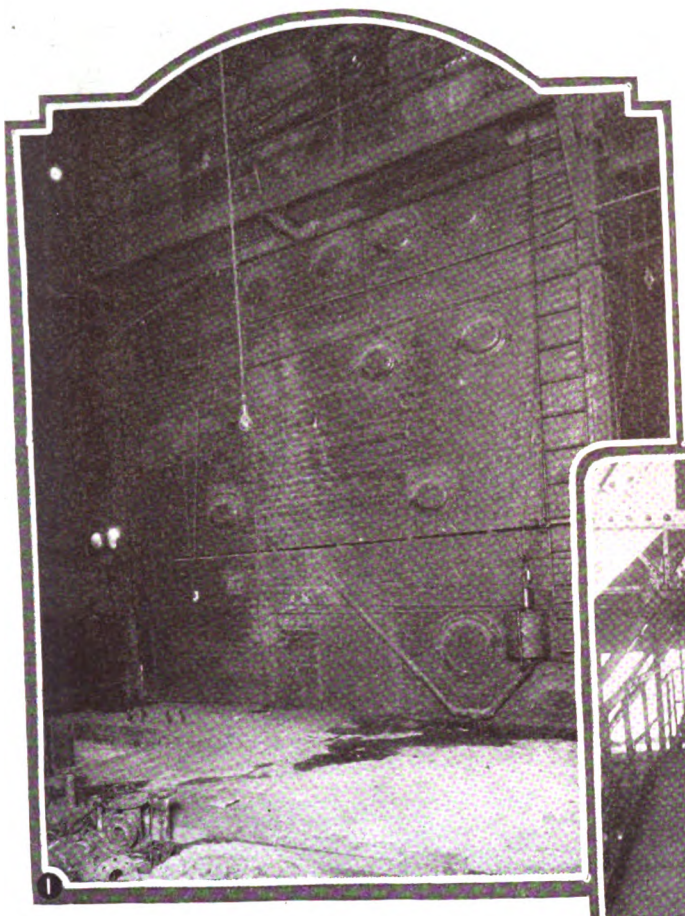


Fig. 1. Automatic damper regulator, which controls the draft condition in the furnace and which often results in considerable increased average combustion efficiency. Such a device takes some of the "human element" out of boiler house operation.

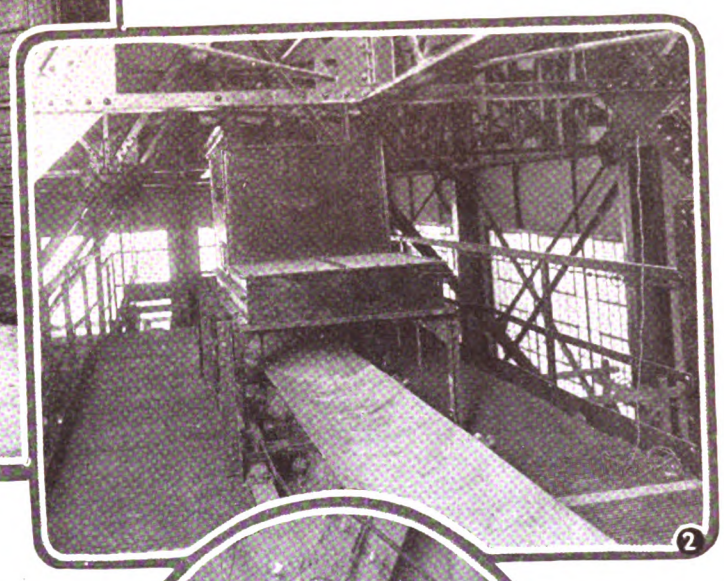


Fig. 2. It is not sufficient to know how much coal you buy by actual railroad weights. It is equally necessary to know how much coal you burn by boiler house weights. Where coal conveyors are used, an automatic scale records this weight continuously.

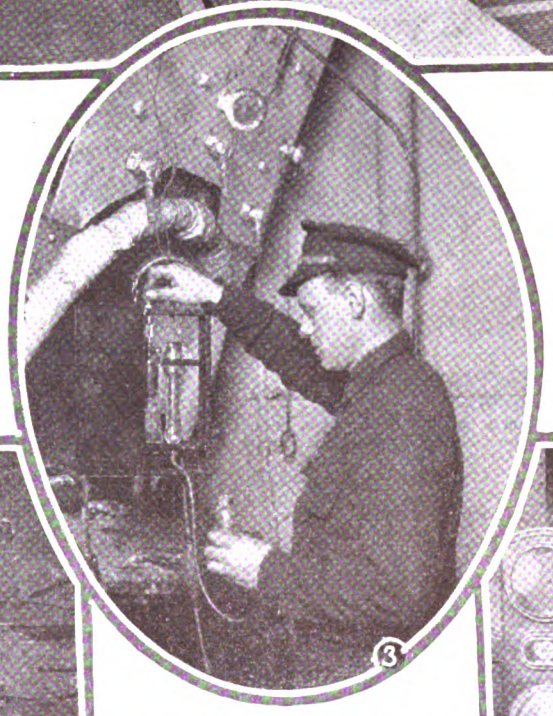


Fig. 3. Correct firing and draft conditions cannot be fully determined without a fairly accurate check upon the percentage of CO_2 in the flue gases. A simple instrument for quickly checking these readings is the hand Orsat.



Fig. 4. The Orsat is a necessary instrument, not only in periodic tests frequently conducted in the boiler house, but also in checking the daily operation of the plant and in determining the correct drafts and thickness of fuel bed. Where recording instruments are used, the hand Orsat is valuable in checking their readings from time to time.

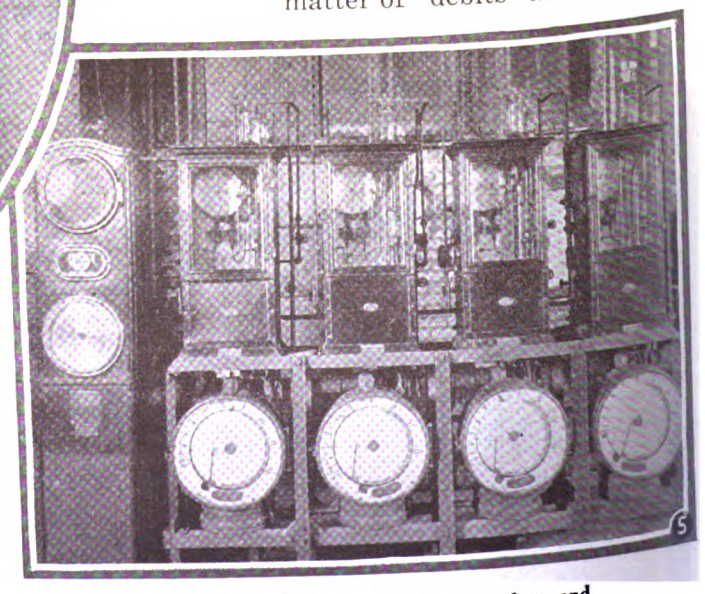


Fig. 5. A battery of CO_2 recorders and steam flow meters serving the boilers in a large industrial plant in the Middle West. Note that a venturi meter is located at the left for measuring also the amount of feed water delivered to the boilers.

There is no good reason why the boiler house of the industrial plant should not be just as profitable as any other department of the plant. Considering it as a unit by itself it is a complete factory for the manufacture of steam. It seems entirely logical, therefore, to expect that, with intelligent management, it should show a profit, just the same as the major enterprise is expected to show a profit.

In the average boiler house, however, this is not apt to be the case. The steam factory is thought of more or less as a necessary evil. There is perhaps not more than one industrial plant in ten that can answer correctly the following simple business questions with regard to their steam power production costs:

1. What does it cost to generate 1,000 pounds of steam?
2. Is this cost excessive for the particular local conditions?
3. If excessive, can it be reduced, and how?
4. Would it be good business to purchase power outside?

There are many reasons why we should expect that a well conducted plant would be able to answer these questions. Boiler room operation is a business, just as much as any industry is a business. In the manufacture of steam under pressure, certain raw materials are essential. With suitable equipment and by a well defined process these raw materials are converted into the finished product, having a definite marketable value. If this secondary enterprise of ours does not show a profit, we have a right to know why.

Boiler house accounting is a matter of "debits" and "credits,"

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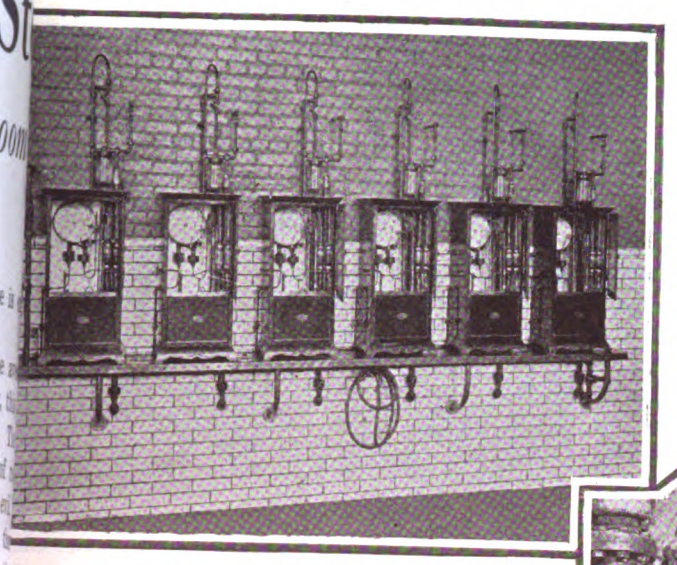


Fig. 6. Where the size of the plant warrants the expenditure, individual CO_2 recorders for each boiler unit give a splendid arrangement. Accurate and continuous check on everyday performance is thus possible.

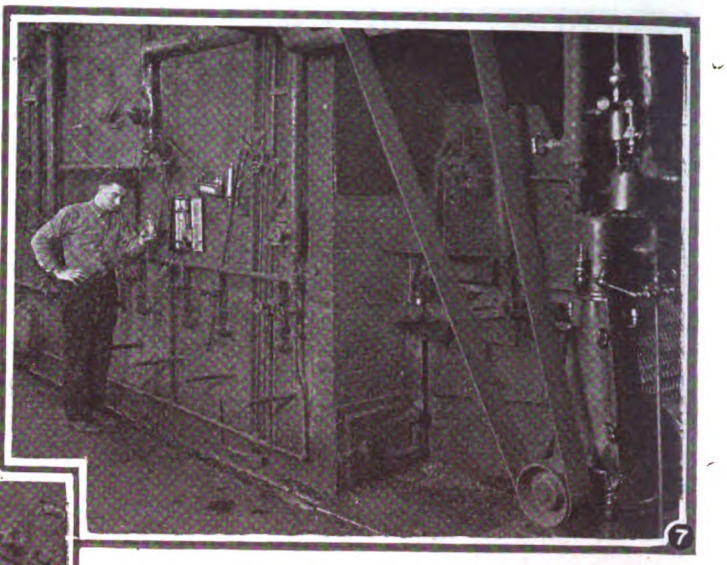


Fig. 7. A simple draft gage in conjunction with a hand Orsat are the most valuable instruments in a boiler room. Quicker results in boosting operating efficiency may be attained by their intelligent use than by any other similar combination of instruments. They not only detect wrong conditions, but when their readings are correctly interpreted, they indicate the source of trouble.



Fig. 8. Even on shipboard the hand Orsat is recognized as a valuable indicator of combustion efficiency. Small industrial plants which cannot afford elaborate instruments are also well served by its intelligent use.

the same as for any other
t department. So many heat
s in the form of coal are de-
red and debited against it.
chief engineer will be held
strict accounting for every
of these units.

n the course of his day's run
urns out so many heat units
he form of steam power, for
ch he must be duly credited.
the limitations of his equip-
nt, his men, and of the pro-
s itself, do not permit him to
ver unit for unit. There are
me unavoidable operating
ses, with which he must also
credited. His job is to keep
operating losses at a mini-
m and maintain the heat
its delivered in steam at a
ximum. The entries would
k something like this:

CR.	B.t.u.	
Tons Coal, 100,000 lb. at 12000 B.t.u. per lb.....	1200	Million
OTAL	1200	Million
DR.	**B.t.u.**	
,000 lb. Steam at 100 B.t.u. per lb.....	720	Million
ses	480	Million
OTAL	1200	Million

A statement like this from the chief places his department immediately on a businesslike basis. It means something definite. A second column on each side of the ledger could easily be added for the value in dollars and cents represented by each of these items.

Such a report could not be rendered with any degree of accuracy, however, without certain information as to plant performance. This information can be secured only by suitable instruments for the purpose.

Some method for weighing coal should be provided. In small plants a platform scale and wheelbarrow may be sufficient. In other plants a railroad scale may be desirable. Where coal conveyors are in service, automatic recording scales are convenient. In some stokered plants a traveling larry with suitable weighing hopper may answer the purpose best.

To determine the heat units in the coal, an actual representative sample of each railroad car should be taken and tested.

The chief must also have proper instruments for measuring the amount of steam he produes. Steam flow meters are easily installed and record with remarkable accuracy. Individual instruments for each boiler unit are desirable, but where

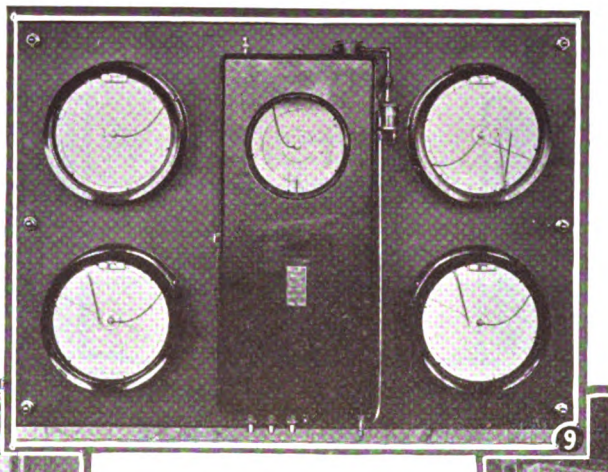


Fig. 9. An instrument board which gives visible information and a continuous record of feed water temperature, draft loss through the fuel bed, steam pressure and percentage of CO_2 in the flue gases.

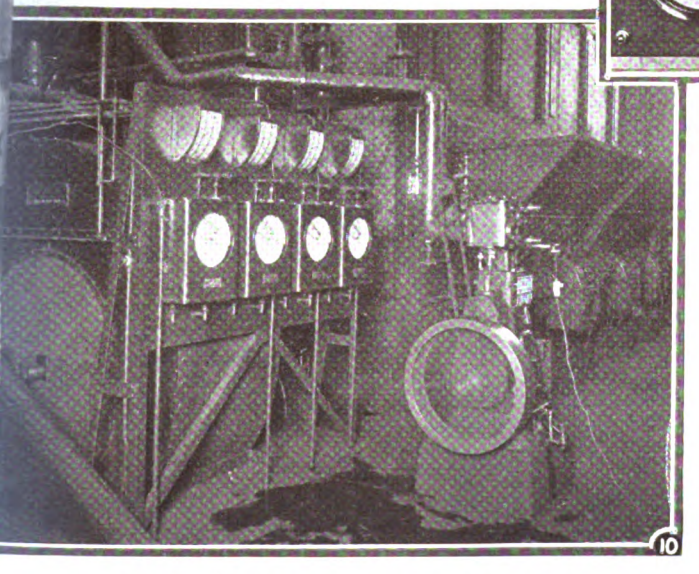


Fig. 10. Distribution of steam load between the various boilers is quickly indicated by individual steam flow meters. When a boiler is not absorbing its share, it is time to determine the cause and correct it.

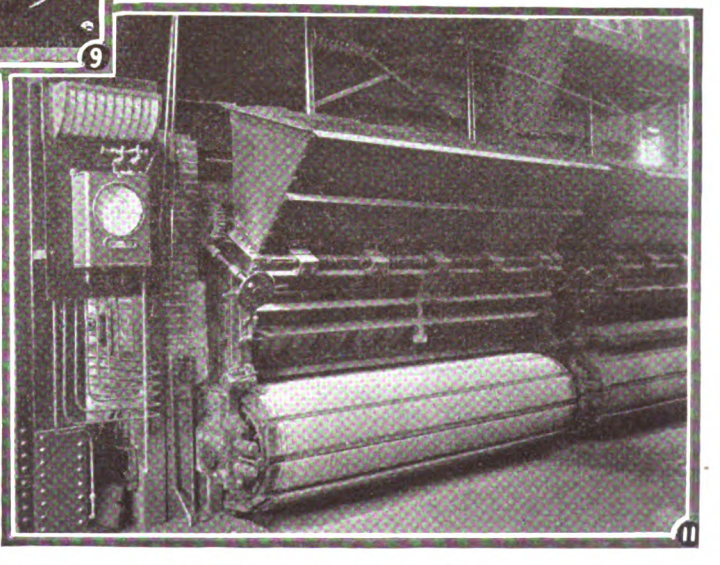


Fig. 11. Individual steam flow meters may be mounted upon the boiler fronts, where they may be seen from the boiler room floor. Meters of this type may also be used to indicate and record flow of feed water to the boilers.

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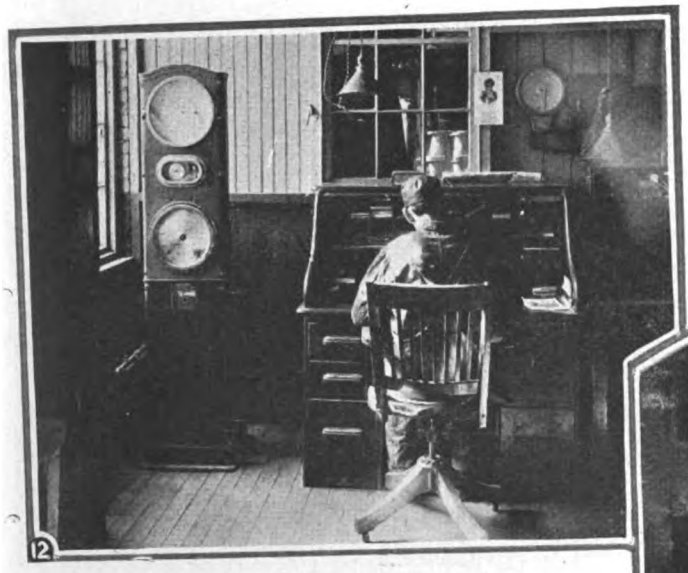


Fig. 12. A venturi meter may be advantageously located in the chief's office, where it is sure to receive proper attention and where the information gained will be used to best advantage.

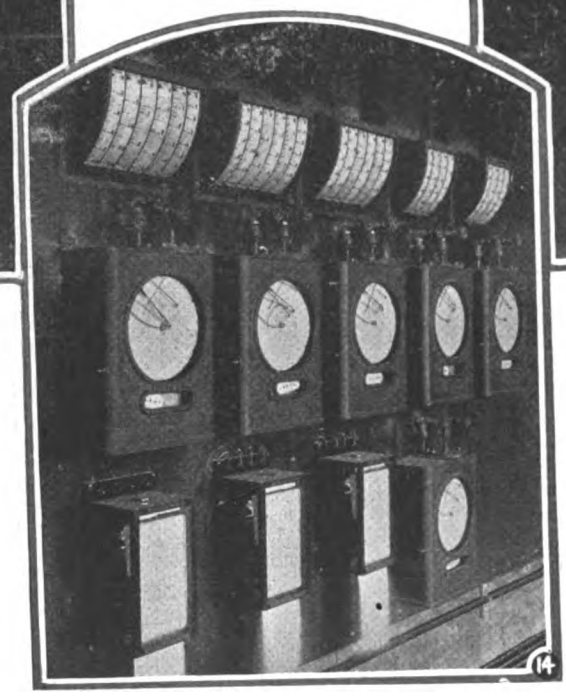


Fig. 14. An instrument board giving instant and continuous information on the amount of steam developed by each boiler, and the temperature of the gases leaving each boiler.

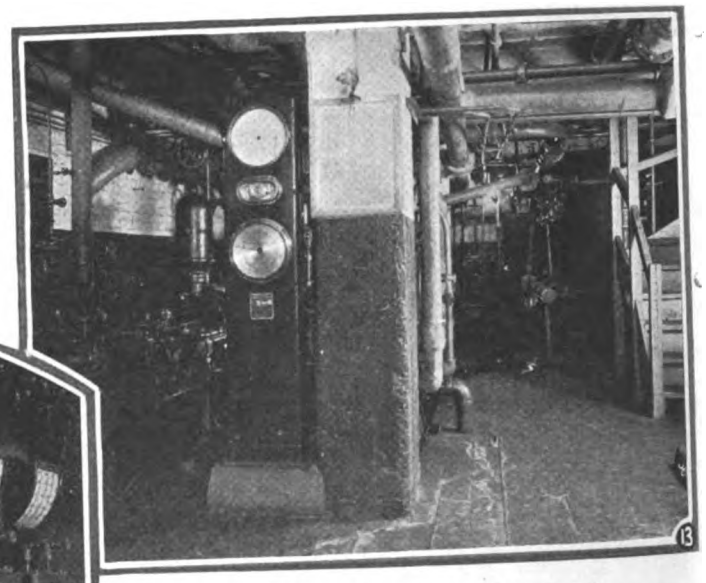


Fig. 13. Typical meter for measuring the amount of water fed to the boilers. In this case the instrument is located in the pump room, where the clean surroundings have a beneficial effect upon its service.

that expense is not warranted, the total steam generated in the plant may often be obtained by one, or perhaps two, meters properly placed. Another method of determining the quantity of steam produced is by recording the number of times a measured volume of feed water passes through the meter. Other types of feed water meters determine the quantity of water passing the meter by measuring its flow over a weir. Still others use the venturi and orifice methods of measuring the flow.

The measurement of the heat units in the steam can be safely left to the ingenuity of the chief, who can readily rig up a simple throttling calorimeter in the steam line. This in conjunction with his steam pressure gage and his steam tables will tell him what he wants to know.

With this simple equipment it is possible to balance total coal used against total steam generated and total plant losses every week or every month as the case may demand.

Valuable as this information is in comparing one month's performance with another, however, it does not tell a complete story. It merely indicates a general trend in plant performance. One month's losses are greater than another's. What were those losses? What were the causes? Were they excessive? How much can they be reduced? What steps should be taken to reduce them?

That is another story.

It is not sufficient, therefore, to know that there are losses. We must be able to control those losses, with a view to increasing useful production by eliminating preventable leaks and correcting wrong conditions.

To do this we resort to another record form, which the chief engineer should keep for his own information and guidance. Let us call it the Heat Balance.

In running down preventable losses, we are not interested in figures on total steam production, nor total coal consumption. But we do want to know how much heat in every pound of coal goes to the production of useful work. The balance is wasted and

(*Continued on page* 58)

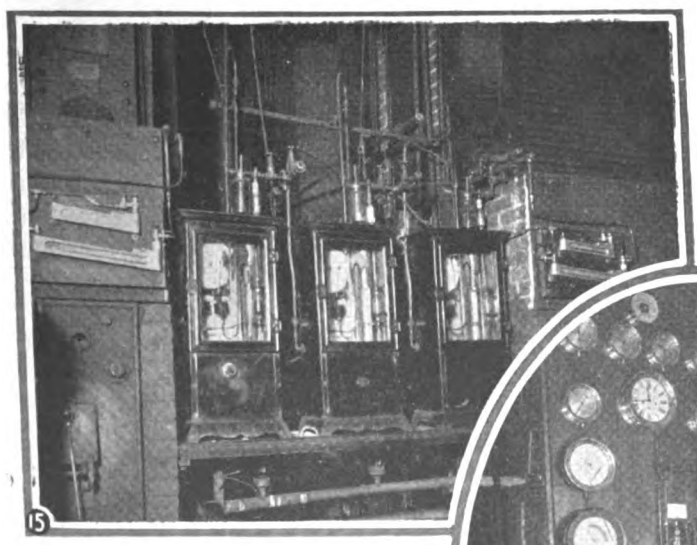


Fig. 15. A battery of instruments recording continuously the percentage of CO_2 in the flue gases. Where expense warrants, these watch dogs of the boiler are valuable assets to the chief. Note the differential draft gages for indicating conditions within the boiler setting.



Fig. 17. Complete instrument board consisting of CO_2 recorder, flue gas temperature recorder, steam flow meter, feed water thermometer and various pressure and vacuum gages.

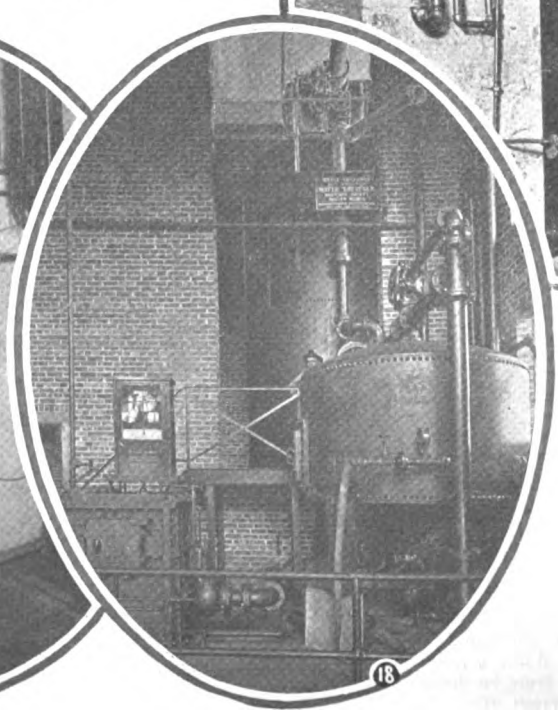


Fig. 18. Feed water may often be advantageously measured by allowing the water to flow over a correctly proportioned weir. An instrument for recording such a flow is shown in the illustration.

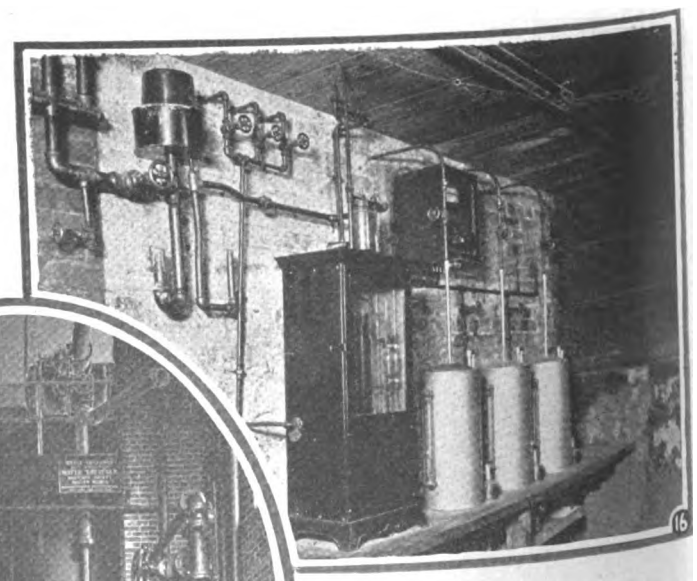


Fig. 16. When individual CO_2 recorders for each boiler are considered too great an expense, a single recorder may be installed in conjunction with individual automatic gas sampling cans.

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Where Tradition Is Still a Handicap

Brick-Making, and Some of Its Surviving Antiquated Methods

BY REGINALD GORDON

IF you ask a bricklayer or a builder some question concerning brick walls or the market price of bricks, he will talk "brick" with you, always using the singular. He tells you that *brick* cost so much per thousand, that being the unit in dealings; or the number of *brick* in a wall of given dimensions, just as we speak of so many tons of *coal*. This is trade vernacular, similar to the English usage of *coals* where we say *coal*.

From the census of manufacturers of the United States for 1919, we learn that the sum of $355,848,355 was invested in the brick, tile, terra cotta and fire clay industries; and that 76,915 wage earners were employed in 2,414 establishments. The total output of these plants during the year mentioned was valued at $208,422,920.

According to a report issued by the United States Department of Commerce, August 31, 1923, the following tabulation shows the quantities of the various kinds of brick produced in 1922 and 1921, and their value:

	1922	1921
Common Brick, Thousands	5,895,615	4,547,900
(Value)	$72,715,640	$57,096,178
Vitrified Paving Brick, Thousands	410,633	468,945
(Value)	$8,967,273	$11,301,409
Other Vitrified Brick or Block, Thousands	75,820	93,000
(Value)	$1,277,998	$1,668,756
Face Brick, Thousands	1,407,853	873,346
(Value)	$28,537,504	$18,128,217
Fancy, or Ornamental, Thousands	15,964	1,996
(Value)	$306,493	$79,762
Enameled Brick, Thousands	16,458	12,756
(Value)	$1,313,633	$1,207,081

There were 1,651 establishments primarily engaged in the manufacture of brick, tile, terra cotta and fire clay products in 1922.

In spite of the ever widening use of concrete, brick continues to hold its own in building construction. In the New York City district alone, in 1922, the quantity of building brick received from yards along the Hudson River was estimated at not less than 720,000,000. In addition, enormous quantities of brick are made in the Middle, Southern and Mid-Western States; in fact, almost anywhere where suitable clay or shale is found at or near the surface.

The making of bricks from sun-dried and fire-baked clay dates back to remote antiquity. It is estimated that the process has been known to man for a period of from 4,000 to 6,000 years. The Assyrians, Egyptians and Babylonians made bricks; and the Chinese appear to have known how to produce hard burned bricks and even to have had a process for glazing them in various colors. In

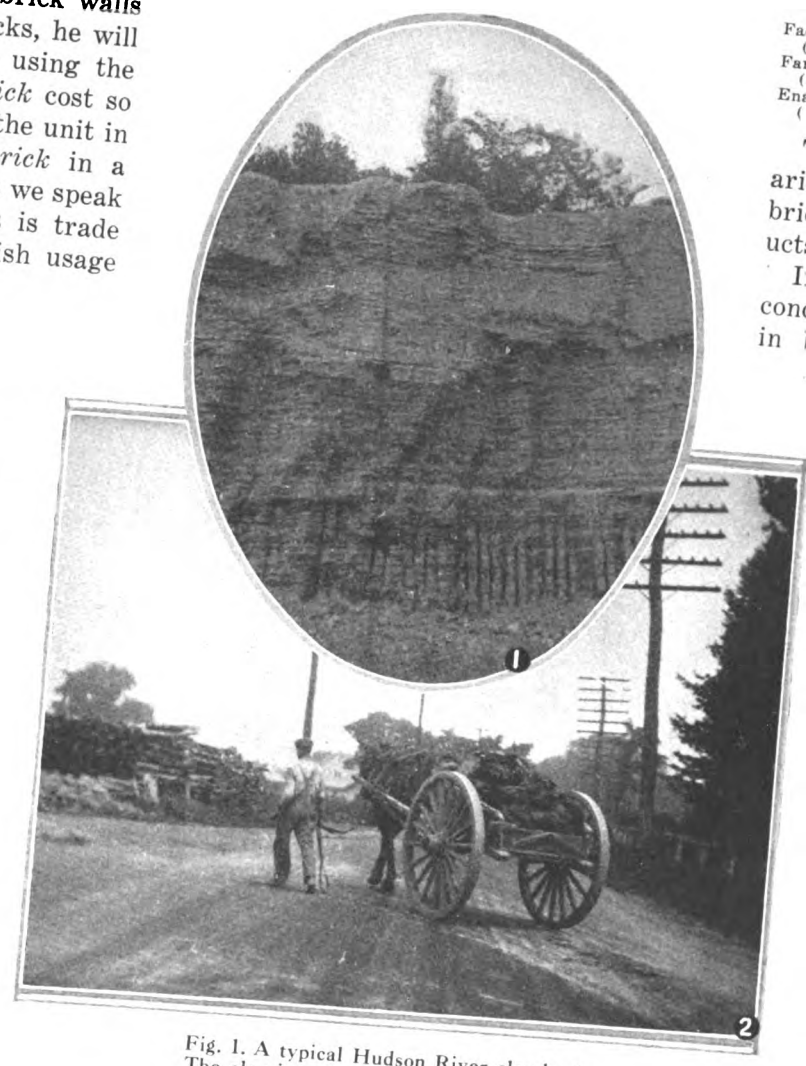


Fig. 1. A typical Hudson River clay bank. The clay is overlaid with strata of yellow shale, which must be stripped off in order to dig out the clay.

Fig. 2. In some localities clay is still carted from bank to mixing pits as shown here.



Fig. 3. Electric locomotive pushing a train of clay cars from the bank to the yard.

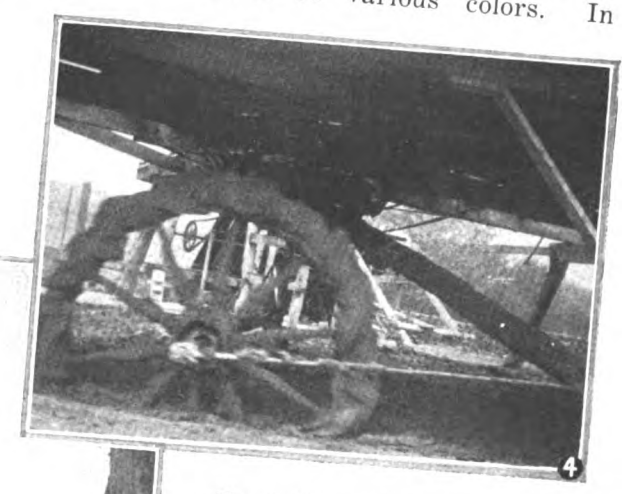


Fig. 4. The method of mixing or tempering the clay shown above has been in use more than one hundred years. The wheel, pulled around the circular pit by the hook, is shifted at each revolution away from, or nearer to, the center of the pit.



Fig. 5. Dumping prepared clay into the hopper of an old style pug mill.

Fig. 6. Truckers wheeling empty molds to a brick machine after dumping the molded brick on the floor of the yard.

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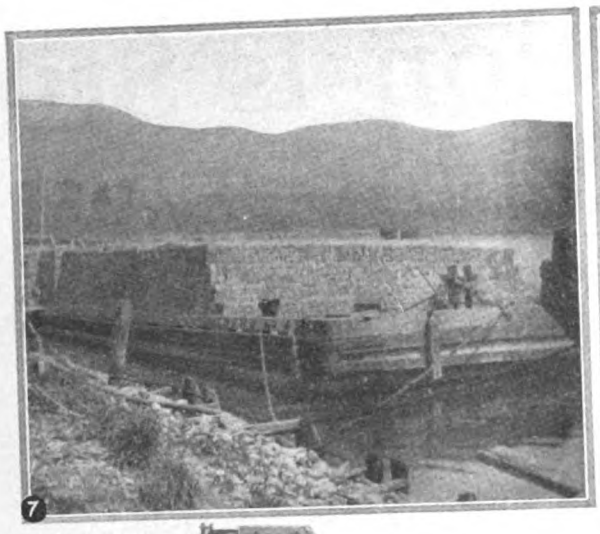


Fig. 7. 350,000 brick ready to be towed down the Hudson.

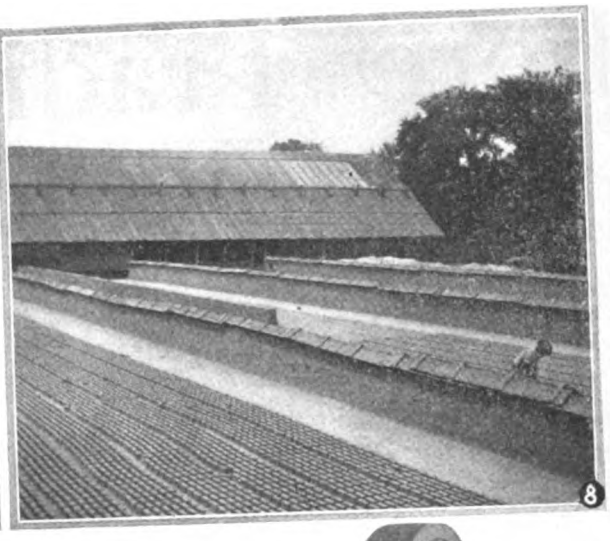


Fig. 8. The brick on the floor of the yard, after partially drying, will be "hacked" up and covered as shown until thoroughly dry.

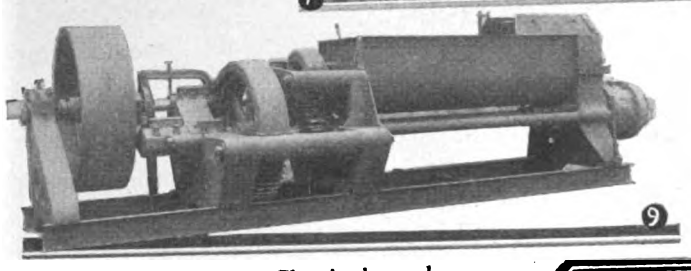


Fig. 9. A pug mill. Clay is dumped into the hopper and pushed along by the revolving knives, which thoroughly mix and knead it into condition for molding into bricks.

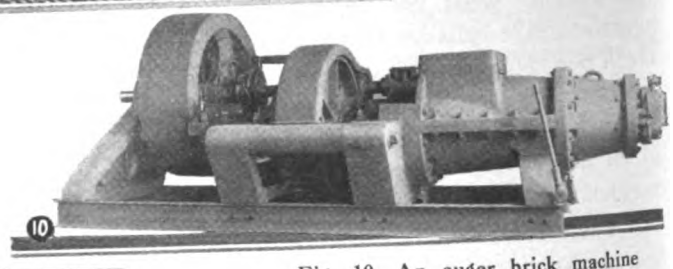


Fig. 10. An auger brick machine combined with a pug mill. This forces the clay through a die from which it emerges in a continuous column, of rectangular section, which is cut into bricks.

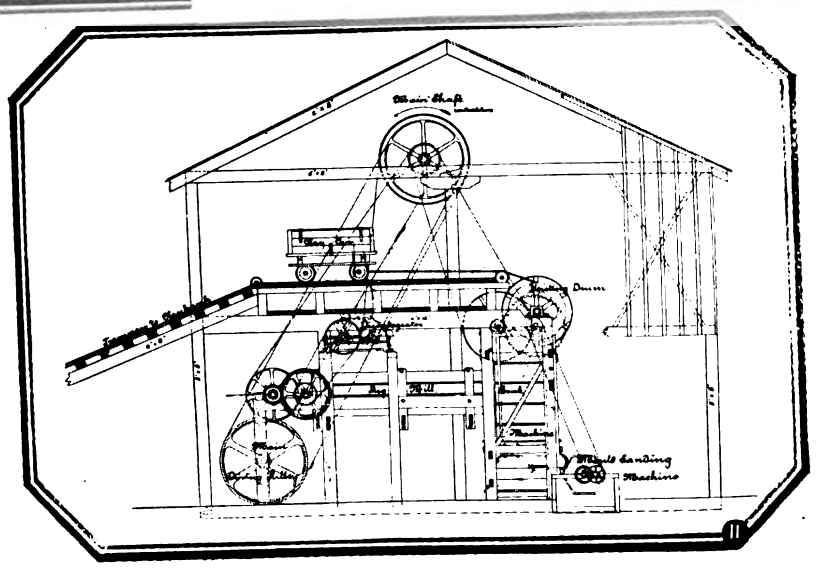


Fig. 11. General diagram of machinery in a modern brick plant.

Egypt, bricks were made by mixing wet clay with finely chopped straw, which served to bind the mass together when dried and baked in the tropical sun. Adobe buildings, still in an excellent state of preservation in Mexico and the southwestern parts of the United States, attest the permanence of this material in dry climates. The first brick buildings in this country were built of bricks imported from Holland; and the earliest date of brick manufacture here appears to be 1650, when a brick kiln was put in operation near New Haven, Conn.

Clay is a widely distributed material, but not all clays are adapted to brick making. In some localities, such as along the banks of the Hudson River and in the Hackensack and Raritan River regions in New Jersey, as well as in certain districts in the Southern States, it occurs as a uniform material of fine grain, free from pebbles and easily excavated; and when thoroughly mixed with water, readily molded into the desired form. In other places it occurs in thin layers of rather hard shale that must be crushed and pulverized before mixing with the necessary water and sand to produce a satisfactory brick.

In certain parts of the United States and Canada, where clay is not available, a very good brick is made of sand and hydrated lime, baked by steam at about 125 pounds per square inch pressure. There are reported to be about 200 plants in the United States and Canada now making these sand-lime brick. The product is dense and hard, of a whitish gray color,

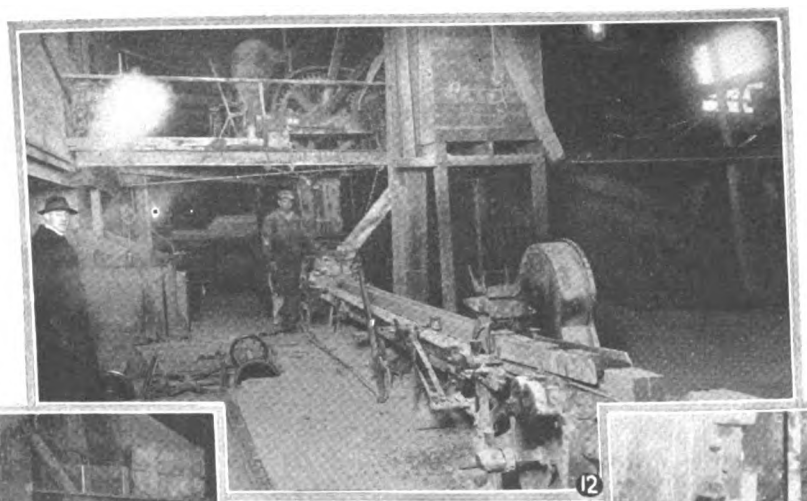


Fig. 12. Here the clay is shown issuing from the die of an auger brick machine and being cut off into bricks by a special cutting machine.



Fig. 13. One of the most modern brick machines. The man attending it inserts a steel pallet, on which seven brick are deposited simultaneously and pushed out. The pallet, with the brick on it, is then lifted off the table, placed on the conveyor, and taken to the dryer building.

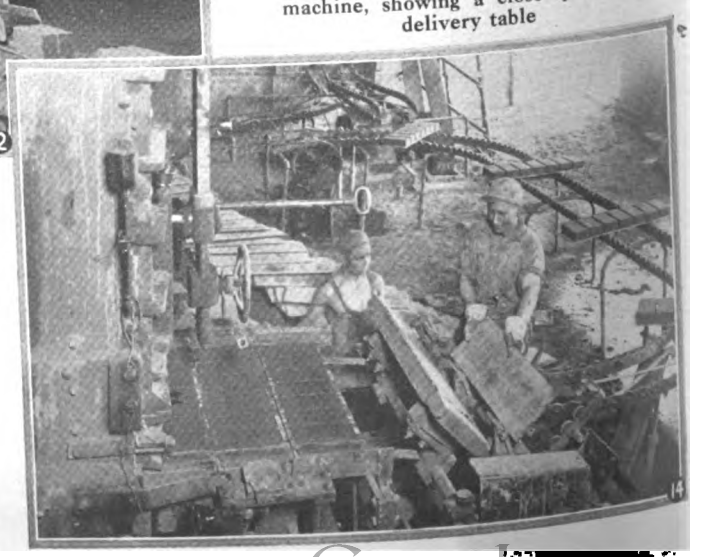


Fig. 14. Another view of the brick machine, showing a close-up of the delivery table

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Fig. 15. Looking down upon the machine, showing the belt conveyor delivering the prepared clay to the hopper above the pug mill and brick press.



Fig. 16. Cars loaded with brick in the dryer. When the doors of the dryer are closed and steam turned into the heating coils, about one pound of water will be evaporated from each brick.



Fig. 17. Old method of putting up a kiln of brick that is still widely used.

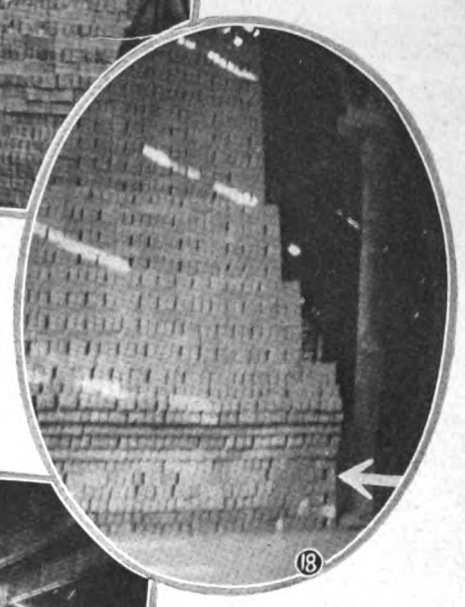


Fig. 18. A brick kiln partially taken down after firing. White arrow shows location of arch in which fire was maintained.



Fig. 19. Machine, operated by overhead traveling crane, which sets one thousand brick at one operation. It is easy to realize the amount of hand labor which this device replaces.



Fig. 20. A close-up of the mechanical brick setter.

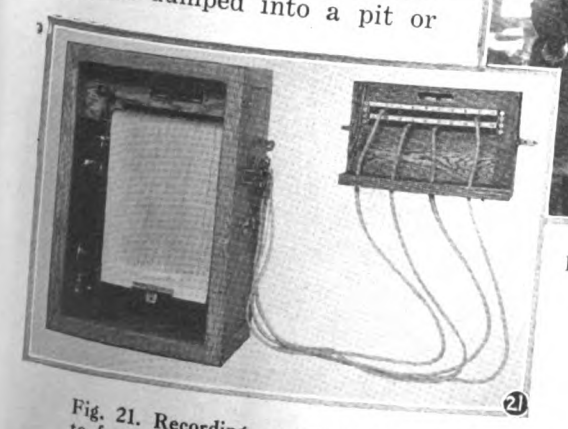


Fig. 21. Recording pyrometer connected to four separate kilns, thus showing the temperature in each kiln throughout a period of twenty-four hours.

and reputed to possess good fire resisting qualities.

Brick clays are, broadly speaking, composed of silicate of alumina and oxide of iron, with a variable proportion of carbonates of lime and magnesia. The iron oxide usually runs between the limits of two and ten per cent., and is the ingredient that is the principal cause of the red color of the clay after firing.

Until recent times, brick making was carried on in a crude, uneconomical manner, using methods and appliances that had remained unimproved for years. In the North, it was strictly a seasonal business, relying very largely on hand labor, which was recruited from a floating class of workers, of all nationalities; men who applied for jobs in the spring of the year and who disappeared when the yards shut down with the coming of freezing weather. Digging clay was done by hand, and hauling by horses and mules. But improved processes and the installation of modern machinery have changed this to a very large extent.

The process of making brick is a comparatively simple one. The clay, excavated from the bank, is dumped into a pit or bin, together with a quantity of sand and some coal dust. This latter, when thoroughly mixed with the other ingredients, is necessary to insure the uniform burning of the brick in the kiln. The mixture is then soaked with water in a large pit in order to render it plastic and capable of being molded in the press of the brick machine. From the soak pit referred to, the clay goes to the machine, which presses and molds it into the form of bricks. Molds usually hold six brick, but there are many machines now in use that make nine brick to a mold. This is one part of the process wherein machinery effects so large a saving of labor, not only in molding faster, but also in pushing out and dumping the molds, thus avoiding a great deal of violent exertion on the part of the men tending the machine. With the old machines, a man was obliged to take the mold from the machine, "thump" it on the table and dump out the brick on the floor.

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Making Seattle a World Port

What Harbor Facilities Mean to Industrial Growth

By P. M. Fogg

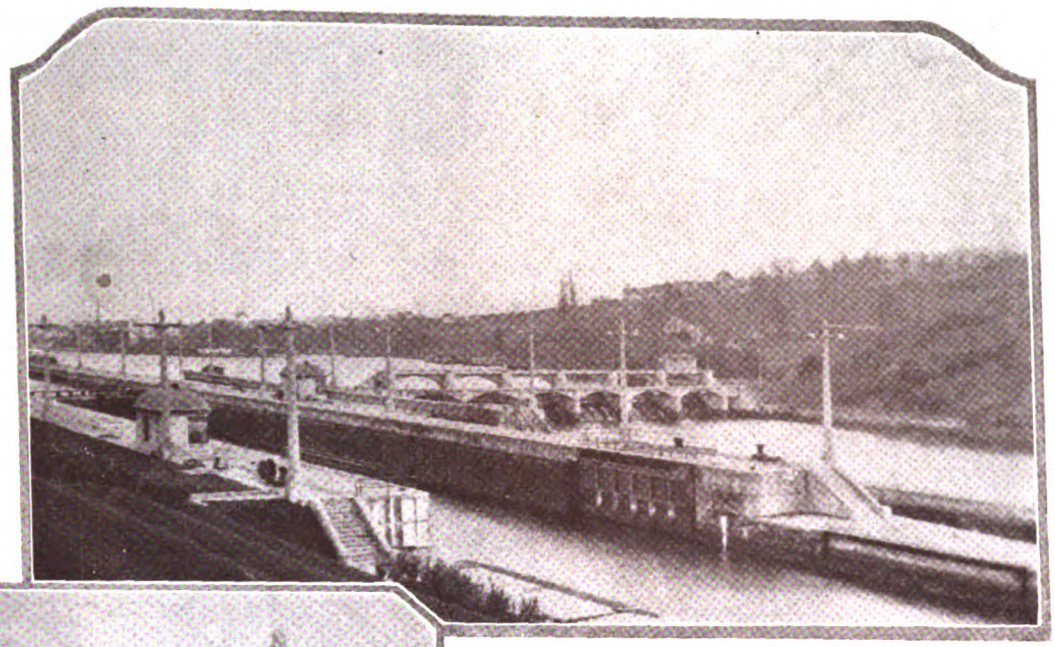


Fig. 1. Above—A general view of the Government dam and locks, Lake Washington Canal, Seattle.



Fig. 2. The concrete dam, which maintains the level of the fresh-water lakes, Lake Union and Lake Washington.



Fig. 3. At the right—One of the great lumber mills along the shore of Lake Union, whose operation was made possible by the canal project.

THE city of Seattle enjoys the benefits accruing from the use of the largest canal locks, with the single exception of those at Panama, ever built by the United States Government. At a cost of $3,570,000 these locks and the waterway in connection therewith, known as the Lake Washington Canal, were constructed a few years ago, at the expense of the Government, the State of Washington and King County, in order to open to the trade of the Pacific what is perhaps the most unique fresh water harbor to be found anywhere.

Lake Union, with a relatively small area, lies in the very center of Seattle's business and industrial district, while Lake Washington, a beautiful body of water, and very much greater in area, forms the eastern boundary of the city. Prior to the completion of the project, both of these harbor sites were inaccessible to sea going commerce.

It required the dredging and extension of Salmon Bay, a natural slough leading from Puget Sound to Lake Union, and the excavation of a short canal between the latter and Lake Washington, to supplement the lock construction and thus render available fresh water anchorage having a shore line of more than a hundred miles.

For nearly a half century before the realization of the dream

(*Continued on page 67*)



Fig. 5. A tug and raft of logs, passing through the large lock, on the way to Puget Sound.

Fig. 4. Below—A close-up of the massive steel gates in the smaller lock, Lake Washington Canal.

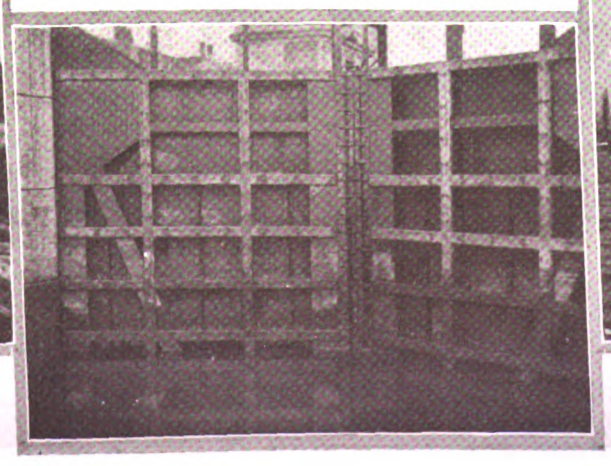
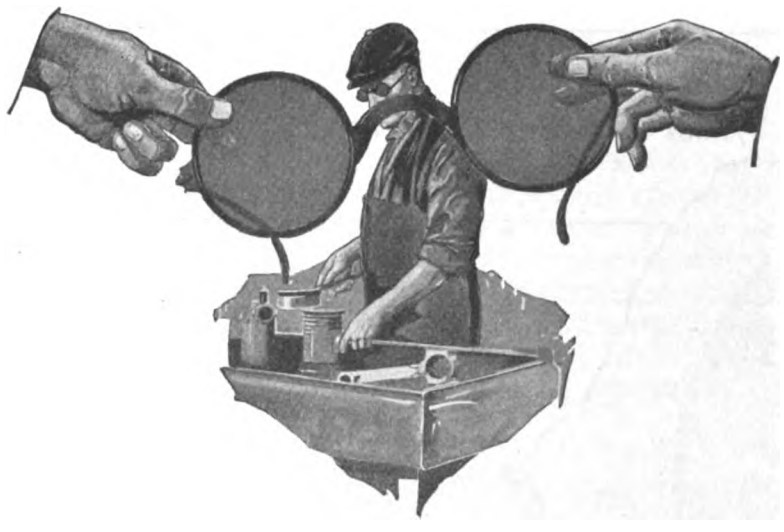




Fig. 6. Lake Union, Seattle; showing its commercial development, made possible through the canal.

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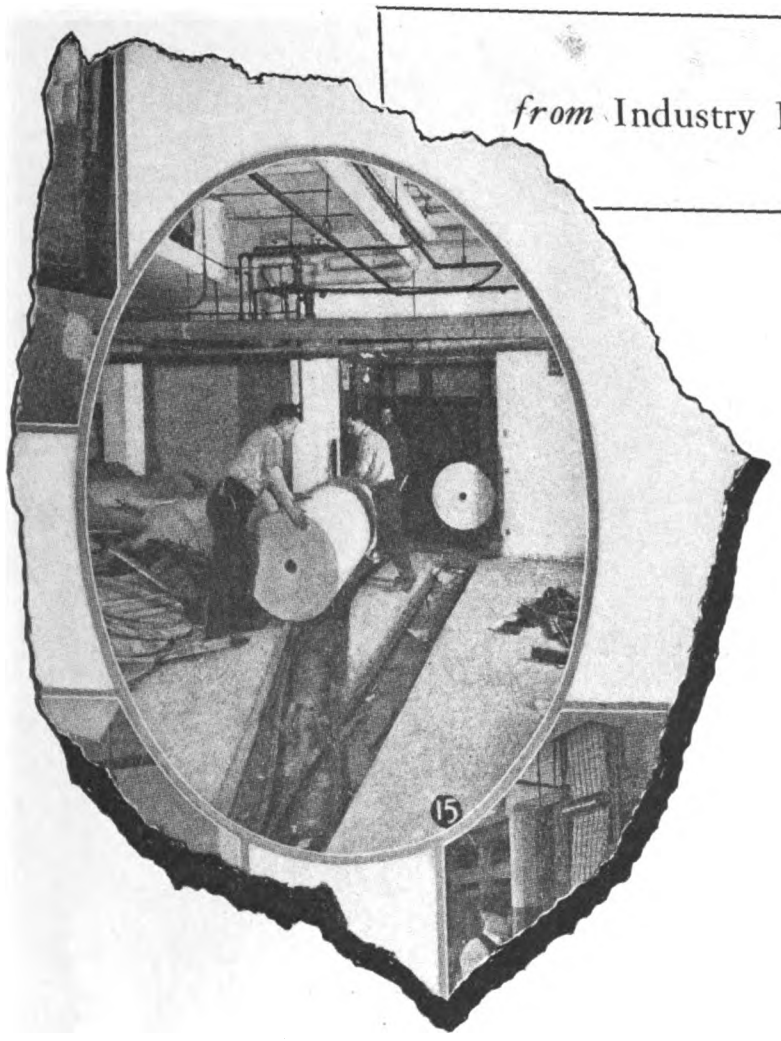
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Piling Up Goods and Profits

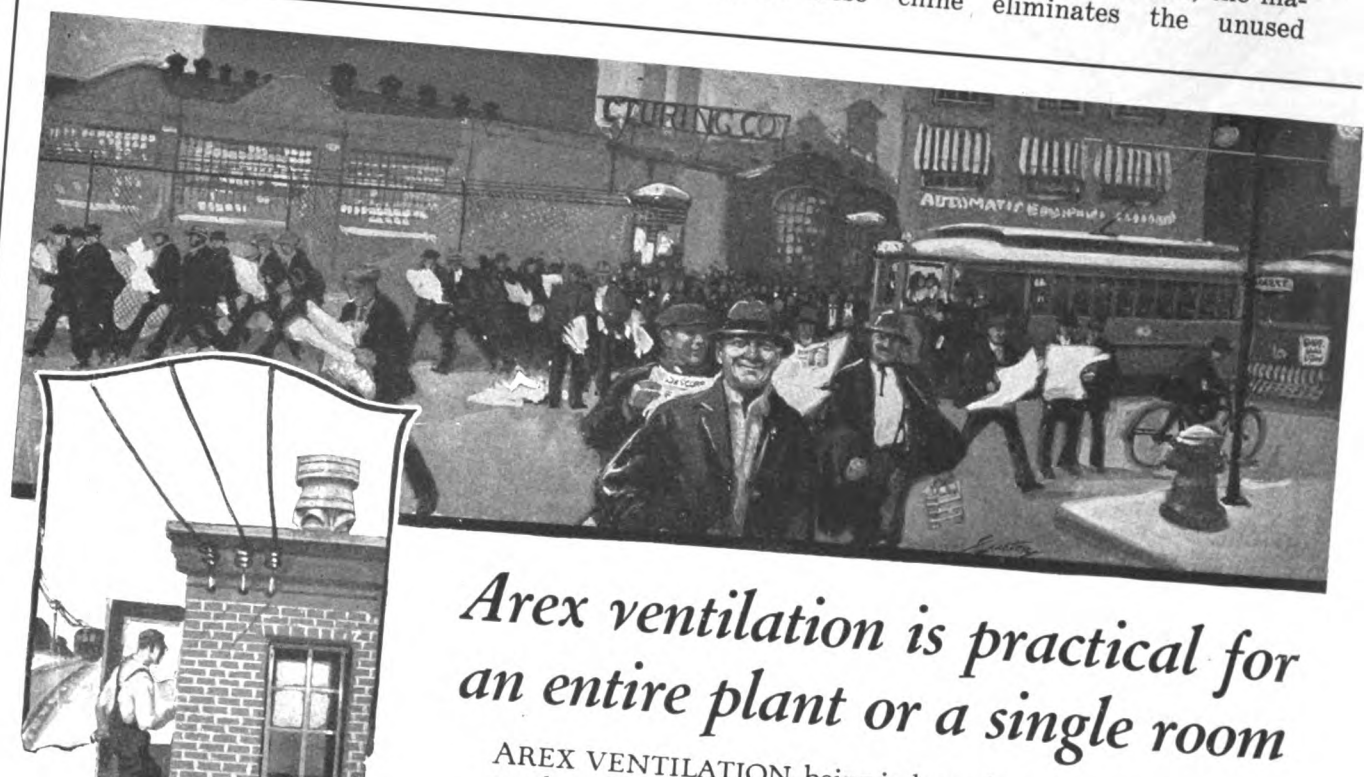
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machine platform by means of a grooved stick. It is also well to equip these machines with live roller platforms, providing they are to be used exclusively on cases, otherwise they should be provided with a flat wood or steel platform, with a live roller attachment which can be easily slipped into place, and which is shown in figure 4. Figure 4 also illustrates a practical and efficient method of handling the top cases on the pile. In order to eliminate the heavy pulling, these men use pipe rollers, so as to roll one package on top of the other. It is then more or less of a trick to get these pipe rollers out from under the packages. By using a crow bar, as shown in figure 4, and placing it under the edge of the top package, with one end resting on the machine platform, it is easy to raise the entire package either for removing or placing the pipe rollers when the package is to be handled. This is one of the little practical stunts which the men easily find out for themselves after the equipment has been in operation.

Figure 5 shows how a similar machine assists in handling bulky bales of materials. It is not only the vertical lift machine that is efficient in storage work, but such equipment as shown in figures 9, 10, and 11 have also been found quite applicable, and have materially reduced piling costs.

Let us take figure 9 or 10 as an example for comparison between hand methods and machine methods of piling. We can safely assume that either conveyor would pile twenty bags high. In fact, the installation in figure 10 has already piled the bags over thirty high. If old hand methods were used, it would require an entirely different method of operation, as it would be necessary to provide space every fifth or sixth tier of bags for the men to stand on. The steps are made necessary because this is the average height to which men can lift. On each of these steps two men would have to be placed, in order to pass the bags from one level to the next. It will be readily seen that the higher the pile, the higher the cost of operation goes. Thus we find that with hand methods, to pile bags five tiers high, requires two men; to pile bags from five to ten tiers high requires four men; to pile bags from ten to fifteen tiers high requires six men, etc., increasing the gang by two men for every additional five tiers.

This means that to pile bags as shown in figure 9 or 10, if hand methods were used, it would require from eight to fifteen men, and when the piles were completed there would still be a loss of valuable space as the steps upon which the men stood while passing the bags from group to group would remain unfilled, and no hand method could possibly fill these steps. The continuous slat conveyor pilers which are shown can pile the bags from twenty to forty tiers high, and one man, or at the most, two men, is all the direct labor cost that needs to be applied against the piling operation. In addition, the machine eliminates the unused





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Made for maximum service not merely the average

TRADE JENKINS MARK

Jenkins Bros

Chase dirt with Air—



Use this handy air gun

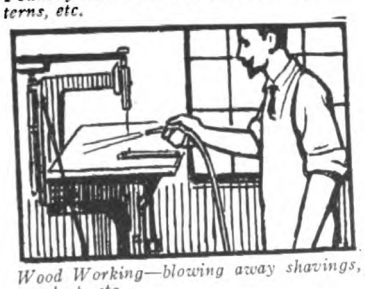
Jenkins Air Gun is light and handy—press the button and it gives a quick blast of air for removing loose dirt, lint, dust, shavings, and the like. It saves time and promotes better work. Fitted with a Jenkins Renewable Disc which prevents air waste, because a perfect contact with the seat is formed when the gun is closed.

30 Days Trial

We will be glad to send you without obligation a ¼-inch air gun for 30 days trial.



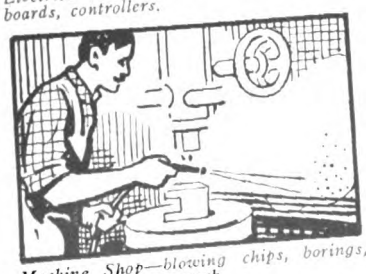
Foundry—cleaning core-boxes, flasks, patterns, etc.



Wood Working—blowing away shavings, sawdust, etc.



Electrical—cleaning armatures, field coils, boards, controllers.



Machine Shop—blowing chips, borings, filings, etc., from work.

JENKINS BROS.

80 White Street.....New York, N. Y.
524 Atlantic Avenue.....Boston, Mass.
133 No. Seventh Street.....Philadelphia, Pa.
646 Washington Boulevard.....Chicago, Ill.



Always marked with the "Diamond"
Jenkins Valves
SINCE 1864

space over the steps, and piles the materials flush with the aisles.

In figuring the savings, in figure 9 alone, we can assume that the machine does the work with two men, making a saving of the labor cost of six men, at 50¢ per man hour. This would mean a saving of $3.00 per hour, or $24 per 8-hour day. At this rate it would not require many days' work to pay for the machine.

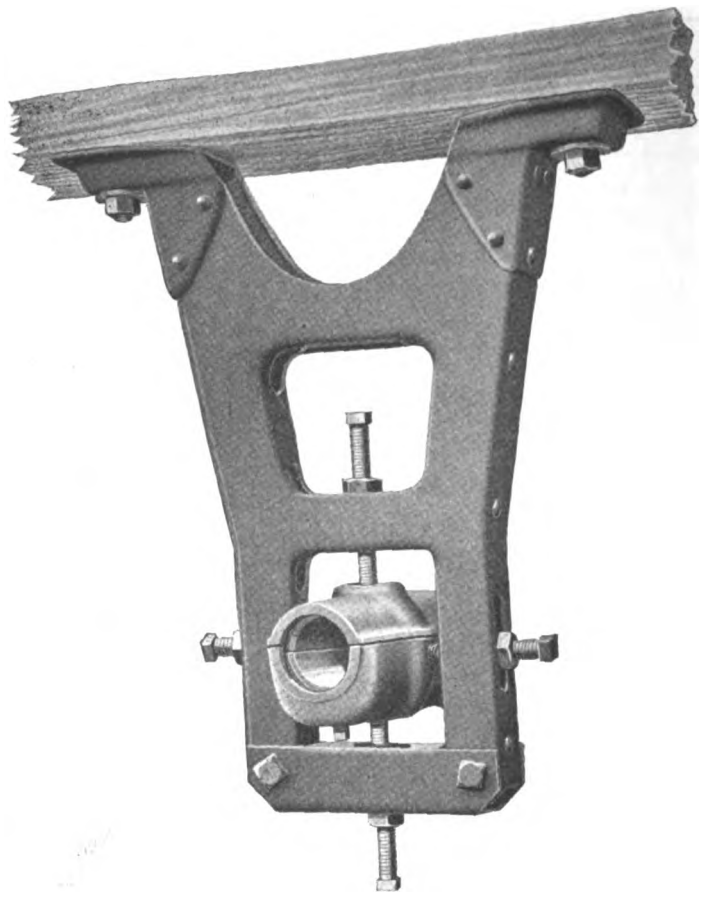
The savings as shown can be realized also in the operation of piling cases, bales, crates, etc., and the heavier the package the greater the savings because more men would be required to lift on each step.

To illustrate this point, we will look at figure 8, where bales of cotton are being piled to a height of over 25 feet, and where formerly the goods were not piled so high, and yet a labor force of over twenty men was required for piling. Now the telescoping portable elevator and three men perform the entire piling operation. In addition, the telescoping feature of the portable elevator, which is quite unique, permits the same machine to pile between the roof trusses as shown, as well as under the roof trusses, without the necessity of continually adjusting or the use of hinged sections. The change from one height of lift to another is accomplished by an ingenious arrangement of sheaves, and the telescoping of the uprights.

Many products, because of their large bulk, have made it difficult to pile, and the result has been warehouse space extravagantly wasted. This was particularly true in the tobacco industry, and the storing of hogsheads of tobacco. Their weight, as well as their bulkiness, made it very difficult to pile them more than one high. In the old method of piling, when it was desired to go two high, which was the best that could be accomplished, the practice was to put a wooden horse support under two planks, and then to lay ropes on the floor, so that two men could roll the hogshead up to the edge of the plank, and adjust the ropes around the cask. Six men on top of the first tier then pulled on the ropes, and as the hogshead moved forward up the planks, the men on the floor put blocks under it, so that it would not roll back while the other

(*Continued on page* 33)

Specify Dodge Steel Hangers for these good reasons



They are—

Light—strong—safe—easy to erect, unbreakable and low priced.

This hanger has broad feet of malleable iron securely riveted to frame which is of box form, spot welded and riveted to insure rigidity and ample strength. Capillary or ring oiling bearings can be furnished. Either type provides positive uniform lubrication with no attention aside from draining and refilling once every six months.

Dodge Pressed Steel hangers are sold from stock on the immediate delivery basis by local mill supply and machinery dealers.

DODGE MANUFACTURING CORPORATION

General Office: Mishawaka, Indiana; Works: Mishawaka, Ind., and Oneida, N. Y.

New York Boston Philadelphia Pittsburgh Cincinnati Houston Chicago St. Louis Atlanta Minneapolis Seattle San Francisco Newark Oneida

DODGE

POWER TRANSMITTING EQUIPMENT

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Above—Delta Elevator, used in fixed position. With special 72" platform to handle 3000 lb. cases of French plate glass. This is a twin drum, twin rope machine. The cases are rolled on platform with a dolly, elevated to a mezzanine, automatic limit set to stop at that height. An example of one of the innumerable uses of the Delta. Illustration at the right shows a standard electric for portable use.

Announcing

Recent Improvements in PORTABLE ELEVATORS *that Boost Production Cut Operating Costs Reduce Maintenance Increase Safety and Make Practical their Use for Fixed Positions*

The new and other features of the Delta Portable Elevators all tend to speed up the men, give absolute safety, save the mechanic's time and the expense of repairs and adjustment. The construction and electrical control of Delta Portable Elevators are so simple that any laborer can easily understand their operation instantly.

The outstanding improvements on Delta Portable Elevators emphasize further the following advantages:

Speed—saves the time of men standing by while load is being moved, of waiting trucks and saves car demurrage.

Safety—does not depend on mechanical adjustment or mechanical knowledge of operation. The safety features eliminate the possibilities of damaged goods, injuries to men and make the machine fool proof.

Simplicity—the Electric Delta is so simple in construction that the only cost of maintenance is an occasional lubrication.

The drive, controller, limits, motors and solenoid are fixed units, connected by fixed wiring. The only adjustment is for brake shoe wear.

Every requirement can be met by our standard line of hand power and electric portable machines. We also build machines to order for special purposes with greater speed, extra height and special platforms, sizes to meet any condition.

The New Features

Automatic Electric Brake—locks when circuit is broken by controller, limits, low voltage or failure of current for any reason.

Automatic Electric Upper and Lower Limits—that break the motor circuit locking the brake, when platform reaches high or low position.

Reversing Type Hoist Motor—controls lowering speed.

Simple Open Arrangement of Parts and Units—no adjustments requiring mechanical knowledge.

Twin Dram, Twin Rope—eliminates side tipping of extra wide platforms.

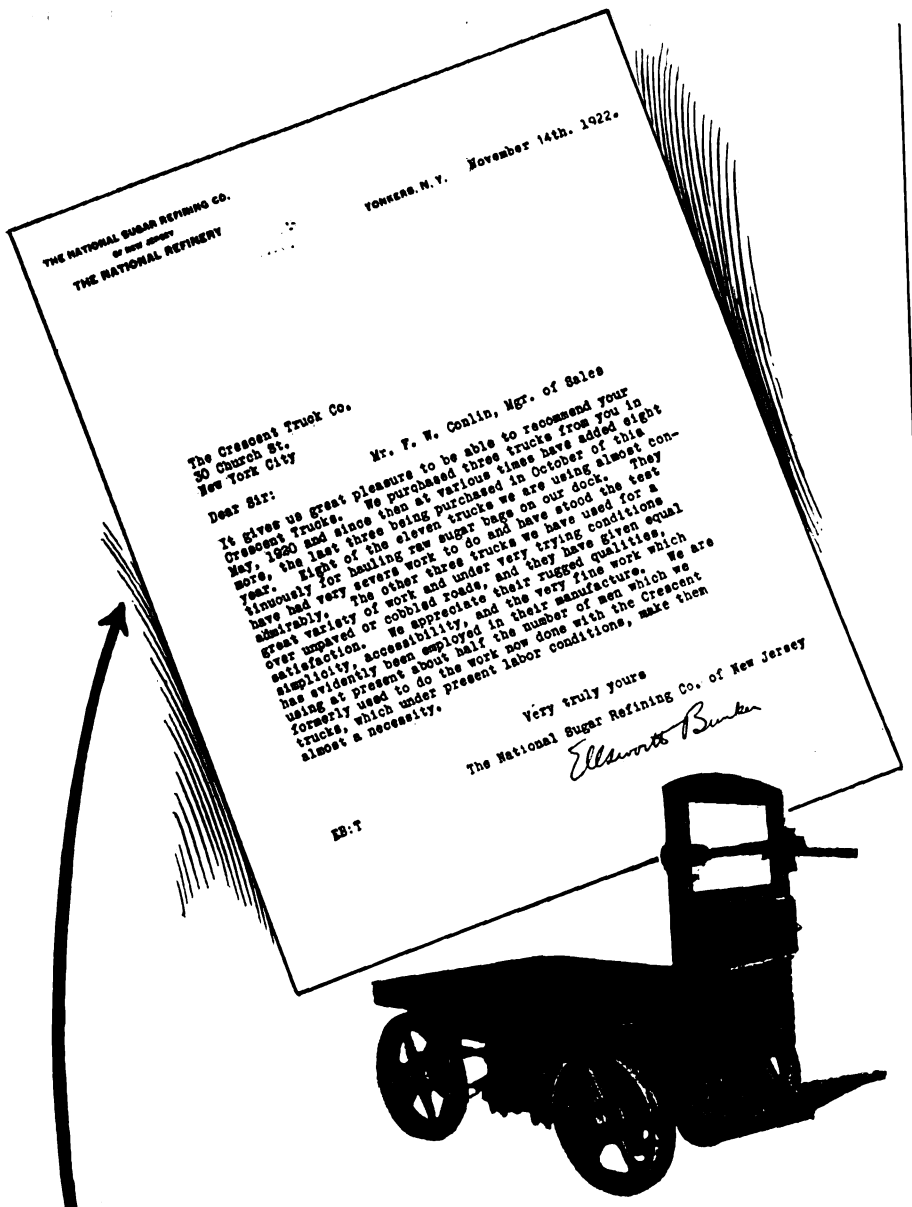
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New Jersey Foundry & Machine Co.

90 West Street, New York City



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Why So Many CRESCENTS Are Used in Fleets

Other Fleet Owners

American Can Co.
American Sugar Refining Co.
Bethlehem Shipbuilding Corp.
Bethlehem Steel Co.
Bush Terminal Co.
Bull Steamship Co.
General Electric Co.
and others.

Standard Parts used on CRESCENT Trucks

Motor—General Electric
Control—Cutler Hammer
Ball Bearings—S. K. F.
Roller Bearings—Timken
Differential—Brown-Lipe

The National Sugar Refinery ordered eight more CRESCENT trucks after the first three proved to possess every quality required of a truck.

We quote from the letter:

> "The other three trucks we have used for a great variety of work and under very trying conditions over unpaved or cobbled roads, and they have given equal satisfaction. We appreciate their rugged qualities, simplicity, accessibility, and the very fine work which has evidently been employed in their manufacture."

In practically every industry CRESCENT Trucks are justifying their original purchase and further repeat orders demonstrate their ability to stand up under every demand of severe service.

Let us send you the complete catalog, showing a truck for every requirement of industrial haulage.

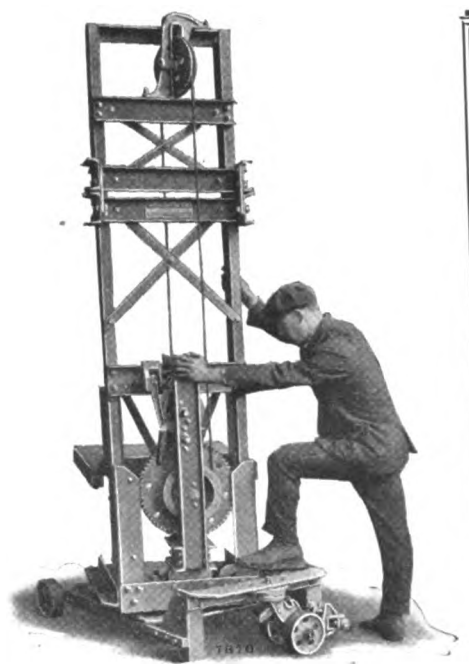
CRESCENT TRUCK CO.

165 No. 10th St., Lebanon, Pa.

Foreign Representatives :: International General Electric Co.

CRESCENT TRUCKS CRESCENT TRACTORS

CRESCENT
ELECTRIC TRUCKS & TRACTORS



Do You Know These Concerns?

General Motors Co.
Ford Motor Co.
Dupont Interests
General Electric Co.
National Biscuit Co.
Standard Oil Co.
National Aniline & Chemical Co.
Imperial Oil Co.
U. S. Rubber Co.
Endicott-Johnson Co.
International Harvester Co.
American Writing Paper Co.

These 12 companies are operating 356 Revolvators. An average of 29 each. One has 44, all have over 17 Revolvators.

Don't use men for work a Revolvator can do

Large companies as well as small concerns use the Revolvator. They want no man doing work that can be done by a machine.

The Revolvator has unlimited uses. It is used to pile bales of textiles, barrels of oil, boxes and crates of merchandise, rolls of paper, etc. When one job is done the Revolvator is easily moved to the next one. Fewer men do more work in less time with the Revolvator than was ever accomplished by labor alone.

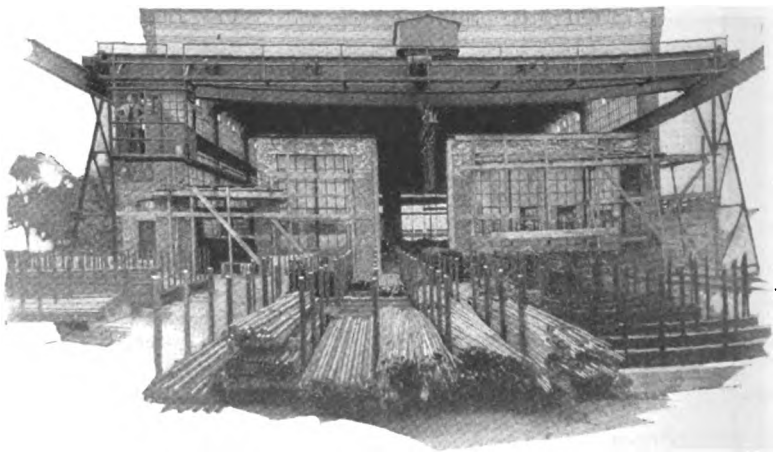
Write for bulletin E-60—send for it today.

Portable Elevators Lift Trucks Barrel Racks

REVOLVATOR CO.

311 Garfield Ave., Jersey City, N. J.

NILES CRANES



For Accessible Convenient Yard Storage

WORKING from overhead a Niles Crane best solves the problem of handling bulky, unwieldy materials in and out of yard storage. The big steel companies were among the first to recognize the economy of the electric traveling crane for this service. You'll find Niles Cranes doing work in such yards, everywhere.

Not only will Niles Cranes handle raw materials, billets and shapes, sand, coke, scrap, etc., cheaper and more rapidly than a gang of laborers, but materials can be stored with greater compactness, no alleyways have to be left, and the Crane will load or unload material at any point without disturbing other materials piled around it.

Niles Cranes have the features of positive and instantly responsive control, simplicity of operation, and unusual strength and safety to specially recommend them for such service.

Niles Electric Traveling Cranes are built in capacities up to 250 tons and larger. We also build Traveling Trolleys, Wall Cranes, Gantry and Gib Cranes. If you have a lifting problem, call our engineers in to help you.

NILES CRANES

For the Steel Mill, Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy material must be handled with speed, safety and economy.

Builders of cranes for every requirement

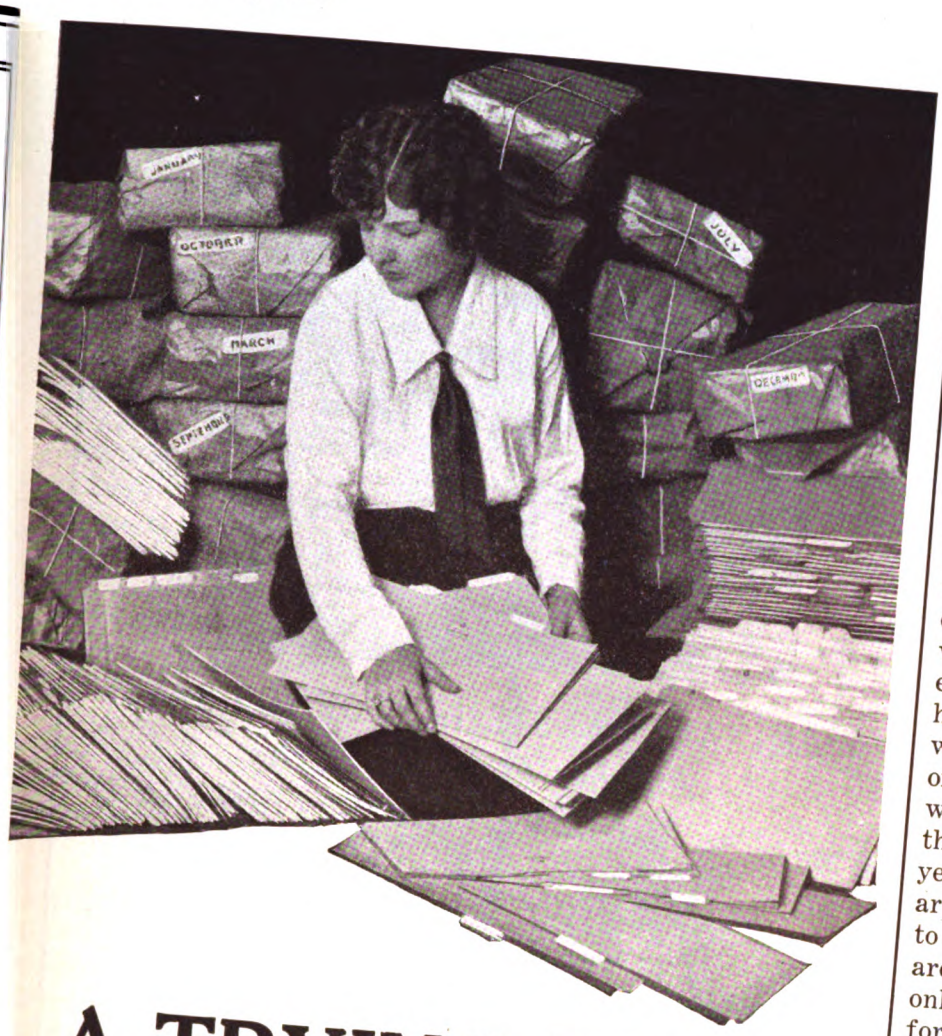
NILES-BEMENT-POND CO.

111 BROADWAY—NEW YORK CITY

CRANE WORKS— PHILADELPHIA, PA.

No. 8 *of a series illustrating the many industries served by Niles Cranes.*

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A TRYING TIME

is Transfer Time; Really *Good* Transfer Cases, Delivered Before Transferring Begins, Are a Big Help!

Front office executives like to be able to push a button and have the correct papers brought to them instantly. That's fine, but those same front office executives should remember that such efficiency does not just happen.

Somebody must bring it about by hard, painstaking work, forethought *and the right kind of transfer cases.*

Van Dorn Transfer Cases are better because: (1) they're closed against dust (no open sides); (2) they save space; (3) they're strong; (4) they interlock rigidly without bolting; (5) they're easy to use; (6) they're good looking; and (7) they cost no more.

There is a grand rush for transfer cases at the last minute. Don't wait. See the Van Dorn now, place your order early and get delivery *before you need the cases.*

THE VAN DORN IRON WORKS COMPANY
Master-Craftsmanship in Steel
CLEVELAND

Branches: Cleveland, New York, Chicago, Washington, Pittsburgh, Philadelphia

Van Dorn
MASTER-CRAFTSMANSHIP IN STEEL

(*Continued from page* 30)

men were getting ready to give another pull on the ropes.

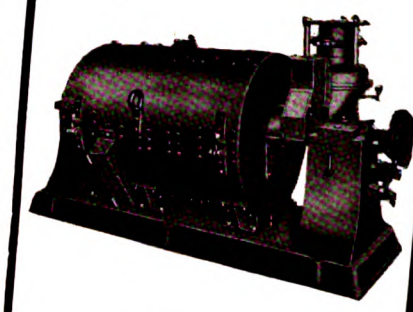
In contrast to this method, the new method shown in figure 7 is presented. Here the cask is rolled on the machine by two men, and swung into position, and by the simple pressing of a button, the hogshead can be piled two or three high, at a very slight cost.

Every industrial executive knows that the fixed cost of maintaining and operating a warehouse is the same whether every inch of space is utilized, or whether the building stands empty, and many executives have searched about to find a way of reducing this fixed cost of providing storage space which is required mainly during three or four months of the year, when the industrial centers are hard hit with snow and sleet, to such an extent that shipments are delayed. This refers not only to the provisions required for maintaining a stock of raw materials for their own manufacturing process, but frequently at the same time of the year it is necessary to provide a large space to take care of the surplus stocks of finished goods, due either to the reason that the users of their products have purchased a large stock previously, and are not therefore ordering new materials, or for other reasons which are known as seasonal conditions of certain industries.

We also find that the space in these warehouses is not utilized to the best advantage, nor has much thought been given to the construction of the building, and the storage requirements. Executives have been reluctant to pile materials high until absolutely necessary because of the high cost of placing bags, barrels, boxes, cartons, etc., higher than two men can lift. This means that in order to take care of two or three months' storage it has been the practice to maintain large warehouse space, which is frequently more than half empty for over 75 per cent. of the year. In order to overcome the large fixed cost of maintaining this idle warehouse space, some executives have dodged the issue by piling material in every conceivable corner of the plant and sometimes under very poor storage conditions, so poor that frequently valuable merchandise is spoiled before it can be used.

(*Continued on page* 35)

Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway
New York

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Making The "INVENT" In INVENTORY Mean Something

INVENTORY TIME IS NEAR!

Why Not Take Inventory In 3 Days Instead Of Wasting A Week On The Job?

MACHINES that not only count scoopfuls or barrelfuls of material a minute, but measure inch or foot contents of bundles of wire, rope and cable and of loads of bar or sheet metal, paper, cloth, leather, etc. They also weigh more accurately than any other dial or beam weighing scale.

Thousands of manufacturers use National Counting Machines. Let us give you the names of many who have cut Inventory time in half or better, using fewer workers than formerly required.

You get Facts—Not Guesswork, when you put National Counting Machines to work in daily service or on Inventory.

We would like to send you complete information concerning models suitable for your requirements. Also please ask for Bulletin C. M. 12.

NATIONAL SCALE CORPORATION
12 BRIDGESIDE AVE. CHICOPEE FALLS, MASS.

Manufacturers

National Counting and Weighing Machines, National Calling System, National "Adjustable" Steel Shelving and National Elevating and Scale-Elevating Trucks.

NATIONAL COUNTING AND WEIGHING MACHINES

ELEVEYOR



ELIMINATES WASTE in STORAGE SPACE

Another Function of the ELEVEYOR (3 Trucks in 1)



Send for the ELEVEYOR Catalog.

This is but one of the many places where an ELEVEYOR in addition to saving the cost of two additional trucks helps in conserving storage space. With the ELEVEYOR you can stock your material six feet in height.

The ELEVEYOR is the Truck that conveys materials anywhere in the plant, elevates and stacks.

Let us show you, by actual experience, what an ELEVEYOR can save in your plant.

ELEVEYOR INDUSTRIAL TRUCK CORP.
56 Huntington Street Brooklyn, N. Y.



Zering Live Platforms Cut Costs

Zering Live Platforms move easily upon ball bearing swivel casters. They economically handle the heaviest loads and make lift trucks unnecessary for short hauls.

Fewer trucks and truckers on your payroll, less material in process, greater factory production and no costly delays upon the shipping floor —these are the big advantages of the ZERING Live Platforms over "dead" platforms.

Zering Live Platforms are strongly constructed of wood or steel in standard sizes to fit truck requirement or can be built to suit any particular need. Prices are surprisingly low.

Zering Platforms can be made to specifications with stake sockets, box or rack bodies. If you have difficult trucking problems we can solve them.

Write for complete information.



THE H. ZERING MFG. CO.
4425 Enyart St., Oakley Station
Cincinnati, Ohio

Manufacturers of trucks, trailers, casters and skids

When you grow sick and tired of truck breakdowns due to having purchased casters "on price" and not quality, ask us for Bulletin 18.

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(Continued from page 33)

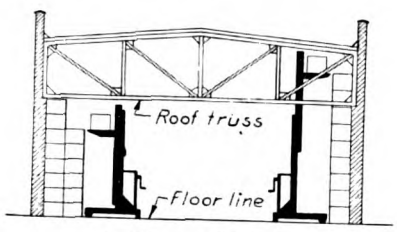
ill, therefore, be seen that eshift solution of the prob- not the real solution, but ite layout should be made e necessary building space ed to protect all merchan- hat is being held in stor- It is true that it is often er to have a large floor than it is to hire addi- manual labor to pile than six feet, but the ex- e waste of floor space is nger necessary because of arge number of materials ing machines and devices have been put on the mar- o eliminate the laborious and the high cost of piling ials.

is equipment consists of ble elevators, conveyors, al racks, overhead cranes, rails, etc., the use of which its the piling of materials aximum heights and in ion has cut the cost of pil- rom 50 to 80 per cent. over al labor costs, and the dif- ce in money saved and the cost of maintaining idle space goes into profits in- of on the debit side of the r account.

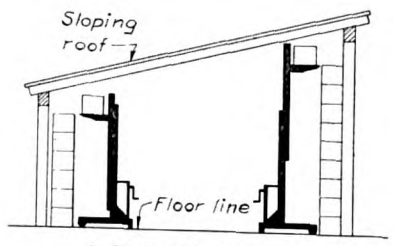
ention was just made that ght should be given to the ge layout, and figures 13, and 15 show why this ght should be given, par- arly in the storage of bar- Figure 13 shows the iod of storing sugar at the annah Sugar Refining Com- , Savannah, Ga., and the els are piled six high, with t is known as long dunnage veen each tier. This form torage is permissible when e stocks of similar products to be handled, and when all materials in the barrels are , but to stand barrels on the nb, as shown, would be im- ctical if liquids were to be ed, because of the excessive kage which would occur due he heavy weights of the up- tiers. It is, therefore, nec- ary in storing liquids, to lay barrels on the bilge, as wn in figure 14, and to pro- e dunnage between each tier. Figure 14 is the interior of oil warehouse, and the build- was designed particularly the storage of this product. nd labor was employed for sing the second tier of barrels o position, and the storage uirements called for consid- ble floor space because of the ny grades and kinds of oil to be stored. For this reason we find some barrels stored two high, while others are tiered one high. This means a consider- able waste of overhead space, as shown, and also high labor costs for piling the second tier of barrels. In addition, the weight of the second tier frequently created enough pressure on the staves of the first tier of barrels to cause leakage, thus making it necessary to break down the pile in order to save the contents of leaking barrels. This meant additional expense whenever it was necessary to rehandle the barrels.

The cost of maintaining such warehouses became so acute that it was necessary to find a better method of storing oil in barrels, and upon investigation it was found that steel racks were being manufactured par- ticularly for the storage of bar- rels, and that portable elevators were also successfully operating in raising the barrels any de- sired height, in order to fit them into, or remove them from, these racks.

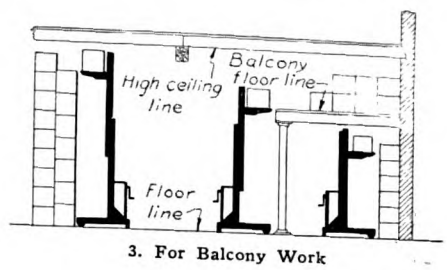
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1. Between Trusses



2. Under Sloping Roofs

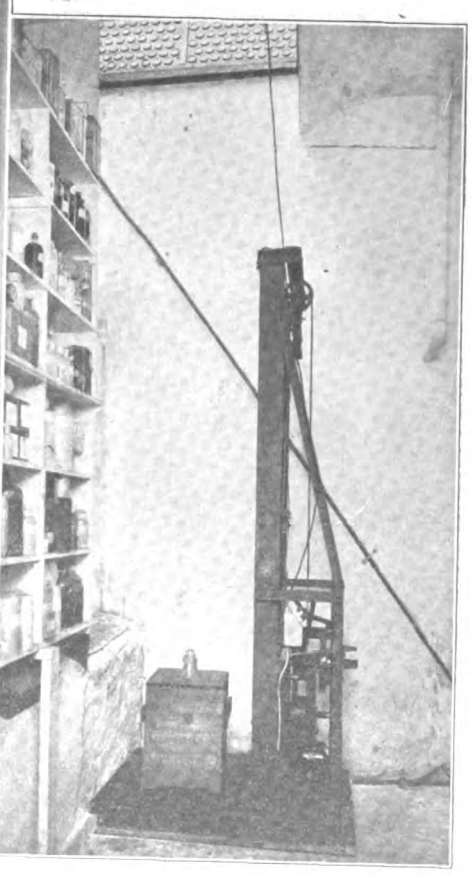


3. For Balcony Work

It Telescopes


Lifting through a sidewalk hatchway or used as a portable elevator anywhere in the basement.

The only portable elevator that will adjust itself to different heights.



Economy Telescoping Portable Elevators

Works up between trusses, steam pipes or skylights, under balconies or sloping roofs, goes through low doors or up through hatchways and into odd corners impossible for a fixed height machine to enter.

Economy Engineering Company
2663 West Van Buren Street, Chicago, Ill.

We have an agent near you. **New York Office: 342 Madison Avenue**

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Six Spindle nut tapper

Every Click of this ROOT counter indicates that 6 more nuts have been tapped Ask us how we would tally the products in your plant



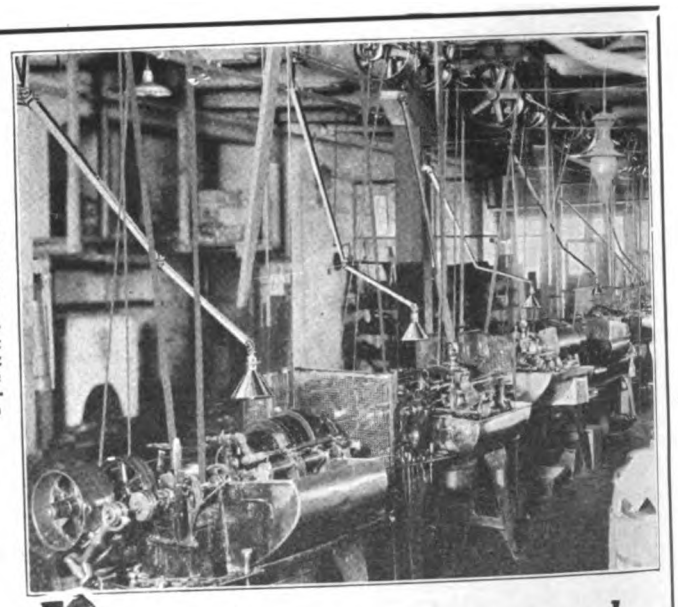
THE ROOT CO.,
Bristol, Conn.
Southern Office: 14½ S. Church St., Charlotte, N. C.

B STAFF

The ROOT Co.

BRISTOL, CONN.

In the Cutler-Hammer plant at Milwaukee precision is of major importance, in small lathe work grinding, buffing, etc. Here American Fixtures put a strong, pleasant light right on the object in hand—no glare, and no eye-strain.



There is a special type of fixture designed for every individual requirement. They are the most practical and yet the most reasonable localized lighting units on the market.



For your own good

—give the men the light they need

Boosting production is largely a matter of adequate lighting. Bringing the light to the work, keeping the worker's eyes from glare and making the details of the job stand out clearly, results in a very definite increase in output, and permanent stop to "rejects."

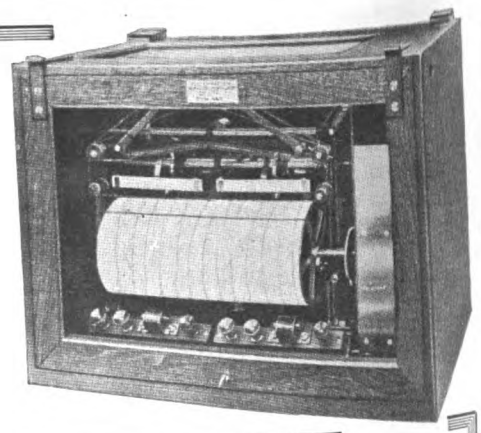
In all kinds of work, from steel stamping to watch making, from bench assembly work to draughting, thousands of American Fixtures are daily doing their bit to produce more economically the goods of the nation.

Let us quote you this month on your requirements.

AMERICAN FIXTURE COMPANY
230 West Water Street
Milwaukee Wisconsin

The patented universal joint permits a turn through a 180 degree arc in all four directions—insuring absolute flexibility.

CAMBRIDGE ELECTRICAL CO_2 RECORDERS INDICATORS



Three Essentials in Boiler Room Recorders

ACCURACY—The improved design and principle of Cambridge Electrical CO_2 Recorders and Indicators make them accurate to a high degree as well as rapid in action.

SIMPLICITY—Cambridge Recorders are entirely electrical—no chemicals to renew. Four CO_2 percentages are shown on one chart, which means four independent readings from four boilers on one chart. This feature saves time and lessens possibility of errors.

RUGGEDNESS—There are no glass or rubber parts in Cambridge Recorders to break or wear out. These unusually rugged instruments can be installed any distance from the flue.

Cambridge Electrical Recorders and Indicators are furnished in a number of ranges to cover practically all boiler room needs.

Other Cambridge Instruments—Electric Distance Thermometers, Thermoelectric Pyrometers, Optical Pyrometers, Pressure Recorders, Draft Gauges.

Write for List No. 157-F, containing interesting data.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC.)
MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

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(*Continued from page* 35)

The racks had these advantages over the old system,

1. Of providing more storage, by utilizing the overhead space,
2. The reducing of labor costs,
3. The racks were so designed that each tier was separate and the first or bottom tier could be removed without disturbing the second or third tier, and vice versa, and thus there was no pressure on any tier because of other material resting upon it.

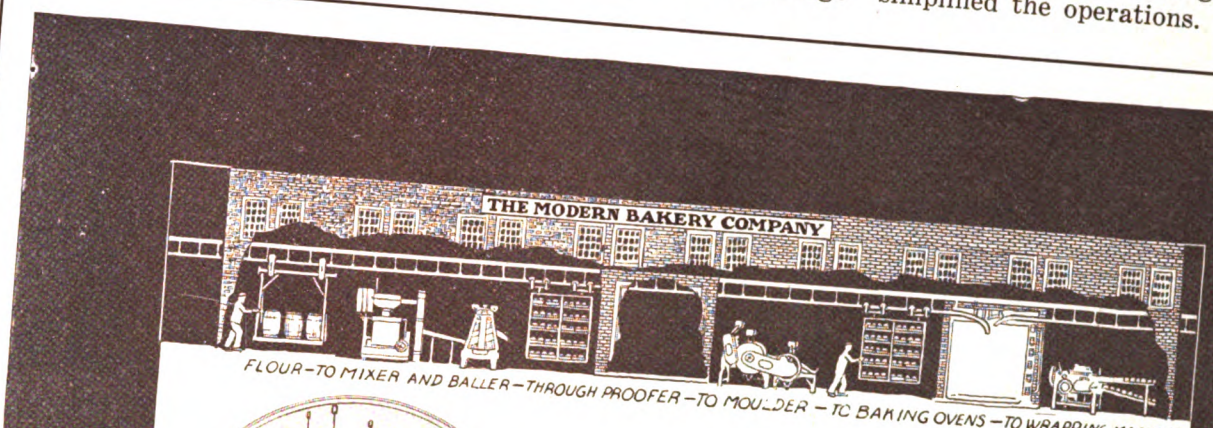
This small feature greatly reduced the number of leakers, and the loss of oil through such leakage.

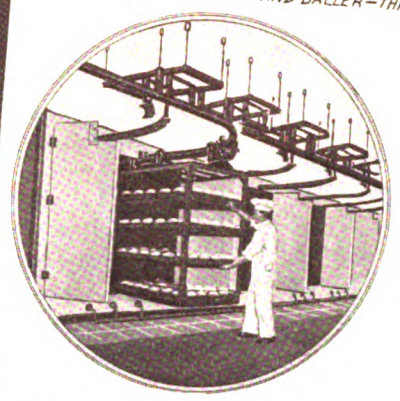
It is desired to bring up a particular point here, as we are trying to show the advantages of a full knowledge of all of the present types of materials handling equipment that can be purchased, and which are considered practically as standard equipment.

It was necessary, after the rack system was found satisfactory, to put the racks in the building shown in figure 14, and while ample overhead storage space had been provided for the old method of storage, it was found that only a few inches were lacking under the center beam, which made it impossible for the racks to be built so as to store barrels four high. In other words, if the rack system had been contemplated in the first place, by making the building a few inches higher, it would have been possible to increase the storage space thirty-three and a third per cent.

To show the possibilities of economical storage, the writer at one time made an analysis of a warehouse layout, where it was necessary to provide a maximum storage requirement for 6,000 barrels of 100 different products. Ninety per cent. of the products were packed in dry form, and ten per cent. of the products were packed in liquid or paste form. All of the products were packed and stored in barrels 26″ bilge diameter, 24″ high, and 23″ chimb diameter. In order to save space, three methods of barrel storage were considered. First, the storage on the chimb, which means the standing of the barrels on end, figure 13; second, the storage of barrels on the bilge, as shown in figure 14, and, third, the storage in steel racks as shown in figure 15. The rack system proved without a doubt the best method of storage, as it allowed systematic stock keeping by groups or classes, and the separate tiers made allotting of stocks simple, convenient and inexpensive, each tier being separate and accessible, and the barrels being held free from those above and below.

With the rack system it was possible to take a complete physical inventory at any time, as all barrels were easily reached by leaving a foot between each set of racks. Another advantage is the ability to utilize overhead space. The use of racks made it possible to tier ten high, or to a height of over twenty feet. The economical advantage of the rack system was the small labor force required to operate the warehouse. It was possible for two men with a portable elevator to place and remove all of the barrels in the stock room. Dry and liquid products were treated alike, so that their storage location in the building was interchangeable, which greatly simplified the operations.





In the Bakery—flour and bread handling methods are greatly improved—the operations are quicker and easier—floor space is conserved—production increased—dust from rolling racks eliminated—and a dozen other advantages—each one a money maker—secured by the use of a *Cleveland Tramrail.*

It's a simple one rail system that hangs from the ceiling beams or roof trusses and is arranged to run through the ovens. It will unload barrels of flour—carry racks of bread—and even load the trucks and wagons.

A "dough" saver in production costs
The handling of flour, dough and bread by hand shoots production cost sky high. A decided saving from the handling of the flour on through until the loaf is wrapped will be realized in every Bakery equipped with a . . . . . Cleveland Tramrail System

It's a man, time, and labor saver that soon pays for itself.

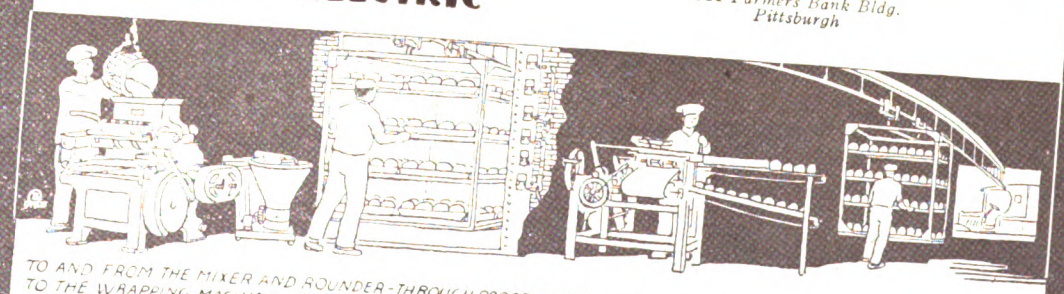
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CLEVELAND TRAMRAIL SYSTEM
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VIA
THE CLEVELAND TRAMRAIL SYSTEM

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backed to the limit. Read How-*now*-to your profit



(1) Lifts in less space
(2) Lifts higher
(3) Lifts with less effort
(4) Lowest upkeep

To demonstrate these all-important advantages of the Jacklift—*PLUS* the tremendous profit to you in savings—we make you this

10-Day FREE Trial Offer

Let us put a Jacklift at work in your plant. We guarantee results — tangible, cost-saving, man-saving, profit-bearing results —*before you pay*

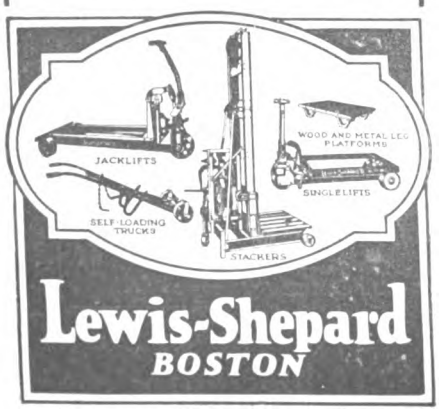
5000 Users in the past 9 years

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LEWIS-SHEPARD CO.
582 E. FIRST St.
Boston, Mass.

Branches in 22 Principal Cities

Canadian Fairbanks-Morse Co.,Ltd.
"Distributors for Canada"



The following tabulation shows the floor space required in this analysis for each method of storage:

Method of Storage	*Floor Area for Storage Alone. Sq. Ft.*
On the Bilge, with dunnage (4 high)	16,375 square ft.
On the Chimb, with dunnage (4 high)	13,650 square ft.
In steel racks (10 high)....	7,150 square ft.

Note: The height of piling is that recommended for safe operation.

This shows that for a given area, more barrels can be stored per square foot by the rack system than with any other method. The more area required for storage, the more main aisle, incoming and outgoing aisle space will have to be added.

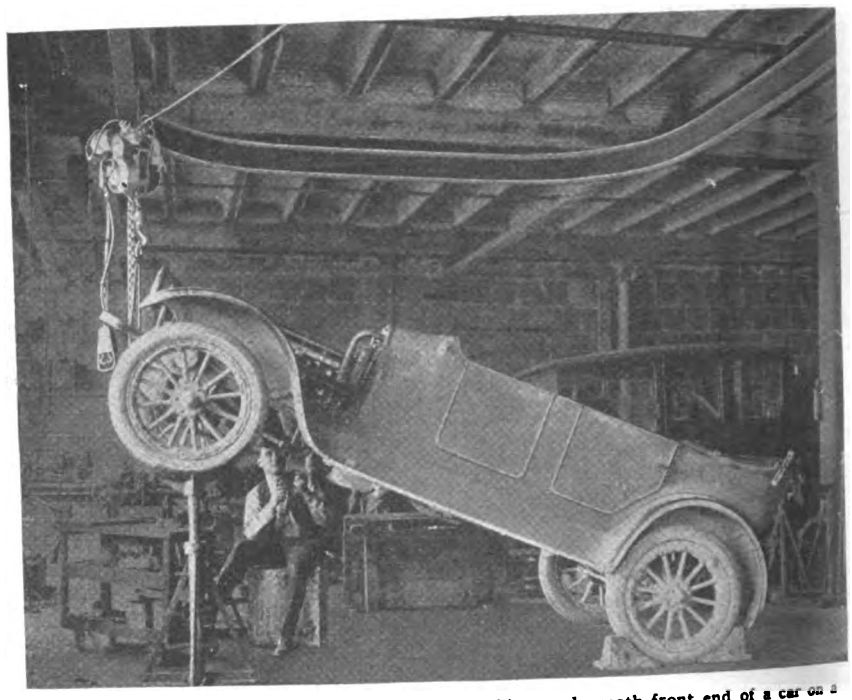
After this analysis was made, it was found that it would be cheaper to provide the steel racks in a high building, than it would be to use up valuable land space, and provide a low building, and use either one of the other methods of storage. The increased height of the building to provide for the racks was only ten feet, and as the building required for storage was only 150x60 feet, it will be seen that the cost for the additional height, plus the cost of the racks, was considerably smaller than would have been the cost of a larger building (300 by 120 feet) regardless of the cost of the land.

It is not always necessary to have the building in place before erecting the racks, and frequently by placing the racks first, a much cheaper building can be provided. Figure 16 shows how one company that was pressed for space purchased the steel racks and erected them in the yard, permitting the barrels to remain in the weather until the building plans and building permits could be obtained and the building erected. The efficiency of storing in the racks was realized immediately, and cut costs long before the building was completed.

Another instance of where materials handling equipment saved money, time and space, was in the problem of storing heavy motor wheel castings, weighing 700 pounds each. These castings were stored in the building shown in figure 17, and were piled only one high, the overhead space being wasted. The wheel manufacturer considered piling more than one high, so as to utilize the overhead space, but the

(*Continued on page* 42)

MOTORBLOC
THE *MOTOR-DRIVEN* CHAIN HOIST



View in a modern garage, showing mechanic working underneath front end of a car on a bearing job. NOTE CONVENIENCE due to the use of MOTORBLOC.



"Saves Labor Costs"

The Motorbloc is portable. It can be hung up like an ordinary hand block in any location where electric current is available, and put in service with the facility of an Electric Drill.
Consumes less than 10 cents worth of current per day.
"Enables one man to do the work of a gang."
Send for Bulletin S-100.

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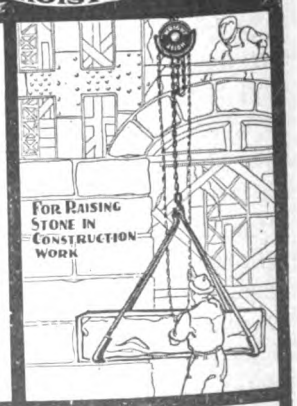
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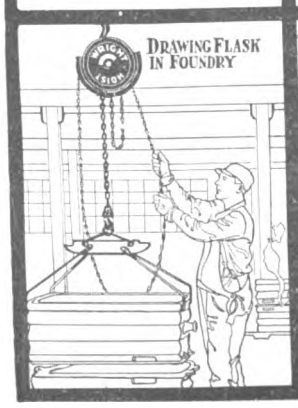
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WE are Hoist specialists and a thorough knowledge of every hoisting problem is our boast. Whatever your lifting requirements may be we can supply you with a Type that "just fits," one with a "built in" factor of safety. Real speed, and absolutely guaranteed dependability and longevity.

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This is Our Offer!

COMPARE this one piece Seamless Steel Kantainer with any can or container you are using. If after a thorough tryout, you are not absolutely satisfied that it is the most useful, durable and economical all-purpose receptacle you have ever used or seen, *your trial will cost you nothing*. Every manufacturing plant, public institution, hotel, club or restaurant can use and profit by the Seamless Kantainer. Every sample brings re-orders. Thousands of Kantainers now in use. Write us today.

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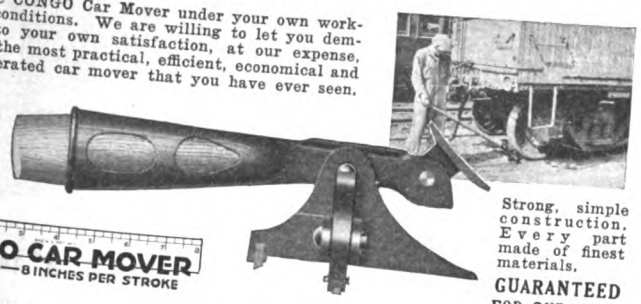


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Made of cold-drawn steel without welding and without a seam or rivet hole. Double thick rim, brazed-on handles or trunions. Sanitary, easily cleaned, absolutely leak proof—can't be injured by cold or heat. Can be filled with heaviest materials and lifted without danger or damage. Stacks to any height. Diameter 16-18 and 20 inches—any height to 30 inches. Plain, painted or galvanized.

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TRY the CONGO Car Mover under your own working conditions. We are willing to let you demonstrate to your own satisfaction, at our expense, that it is the most practical, efficient, economical and easiest operated car mover that you have ever seen.



CONGO CAR MOVER
3 GRIPS—8 INCHES PER STROKE

Strong, simple construction. Every part made of finest materials.

GUARANTEED FOR ONE YEAR

Moves Loaded Cars 8 Inches Every Stroke

The CONGO is the only car mover that will move a heavy loaded car a full eight inches at a single downward stroke. On a level stretch a car can be kept in constant motion.

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Get complete details on this wonderful car mover and our liberal free trial offer—an offer which has absolutely no strings attached. Mail the coupon NOW.

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Let us send you our special proposition to agents outlining the big profit possibilities of this wonderful, quick-seiling product.

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Send me your bulletin explaining the CONGO Car Mover and your free trial offer. It is understood that I am under no obligation.

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Company .....
Address .....



Many uses for the same Hoist

The Great Western Paper Box Co., St. Louis, Mo., puts its Model B Hoist to many uses. Illustration shows how loaded floor trucks and barrels are handled by the same Hoist.

560 Industrial Users

THE G&G Hoist has won its way into all kinds of industrial plants and establishments through its sheer ability to "deliver the goods" at a remarkably low cost of operation.

It affords a sure, dependable means of transporting loads such as boxes, bales, barrels, carboys, etc., between floors—and for removing ashes from cellar level to grade or top of truck.

Various models, electrically and manually operated to meet varying conditions. We will help you select the model best suited to your particular needs.

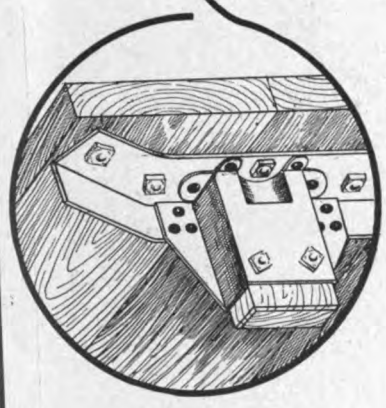
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Telescopic Hoist
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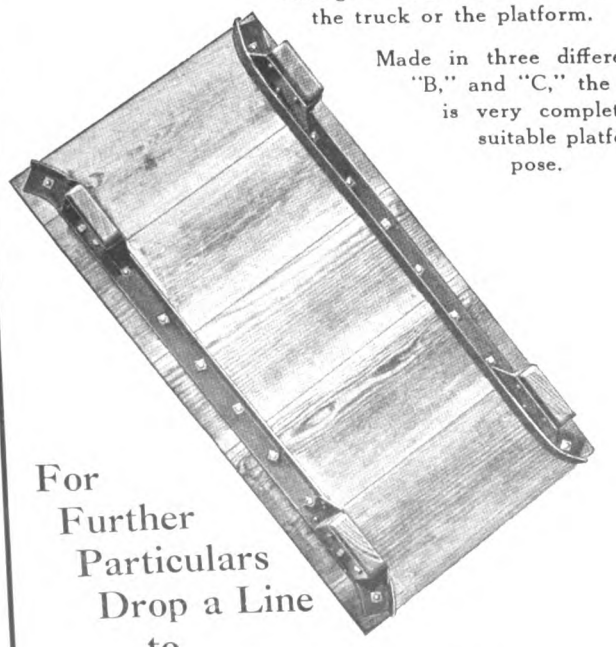
The next time you are buying Lift Truck Platforms

Because it's here that proper construction will show. Because it's here—where the leg supports are attached to the runners—that hard wear brings out inferiorities. Here's where a good part of the stress and strain falls; and it's here that we have incorporated one of the strongest constructions possible in making platforms.

Rivets—hydraulically driven—instead of bolts are used to fasten and hold the steel leg supports to the runners. They cannot work loose; they must hold rigidly and permanently. "Hallowell" platforms are just as steady and firm after years of hard usage as they are the day they're delivered.

And the "Hallowell" specially designed curved steel runner is another feature which will make them popular with your workmen. No matter from what angle a lift truck hits the platform, it slides under easily and without damage. You don't have to "jockey" either the truck or the platform.

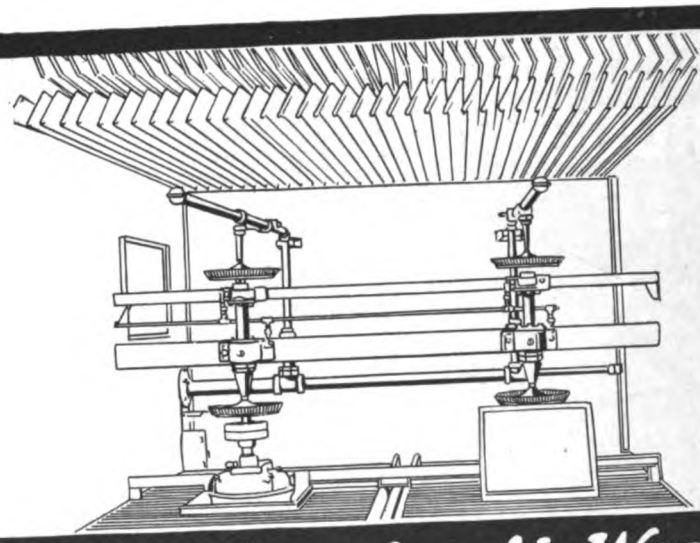
Made in three different types, "A," "B," and "C," the "Hallowell" line is very complete and offers a suitable platform for any purpose.



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(The "Pioneer" Steel Hanger People)



A Non-Clogging Air Washer with Tandem Atomizer.

The illustration above shows top view of the atomizer chamber of a

Bayley Turbo Air Washer

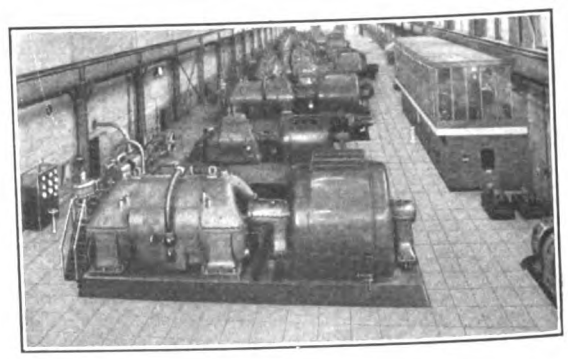
The four motor operated sprayer discs create a very dense double spray of infinitesimal particles of water through which air must pass before it enters the room. In this passage through the screen solids, dust, soot and other impurities are removed from the air, leaving it pure and sweet as after shower breezes.

As a conditioning unit it will keep temperature and humidity uniform throughout the year, regardless of weather conditions. Unique construction of the atomizers keep the water spray uniform in density and clogging is entirely eliminated.

Especially designed for churches, schools, theaters, food producing establishments, hotels, public and office buildings.

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The illustration shows a Marbleloid Floor installation at the Brunots Island Station, Duquesne Light Co., Pittsburgh, Pa.

MARBLELOID
The Universal FLOORING for Modern Buildings

is a perfect industrial plant floor for every room from office to laboratory. It is a fireproof, composition material, very strong, exceptionally durable, non-abrasive, vibration-resisting and non-dusting. Attractively colored, warm, resilient, non-slipping and easily cleaned.

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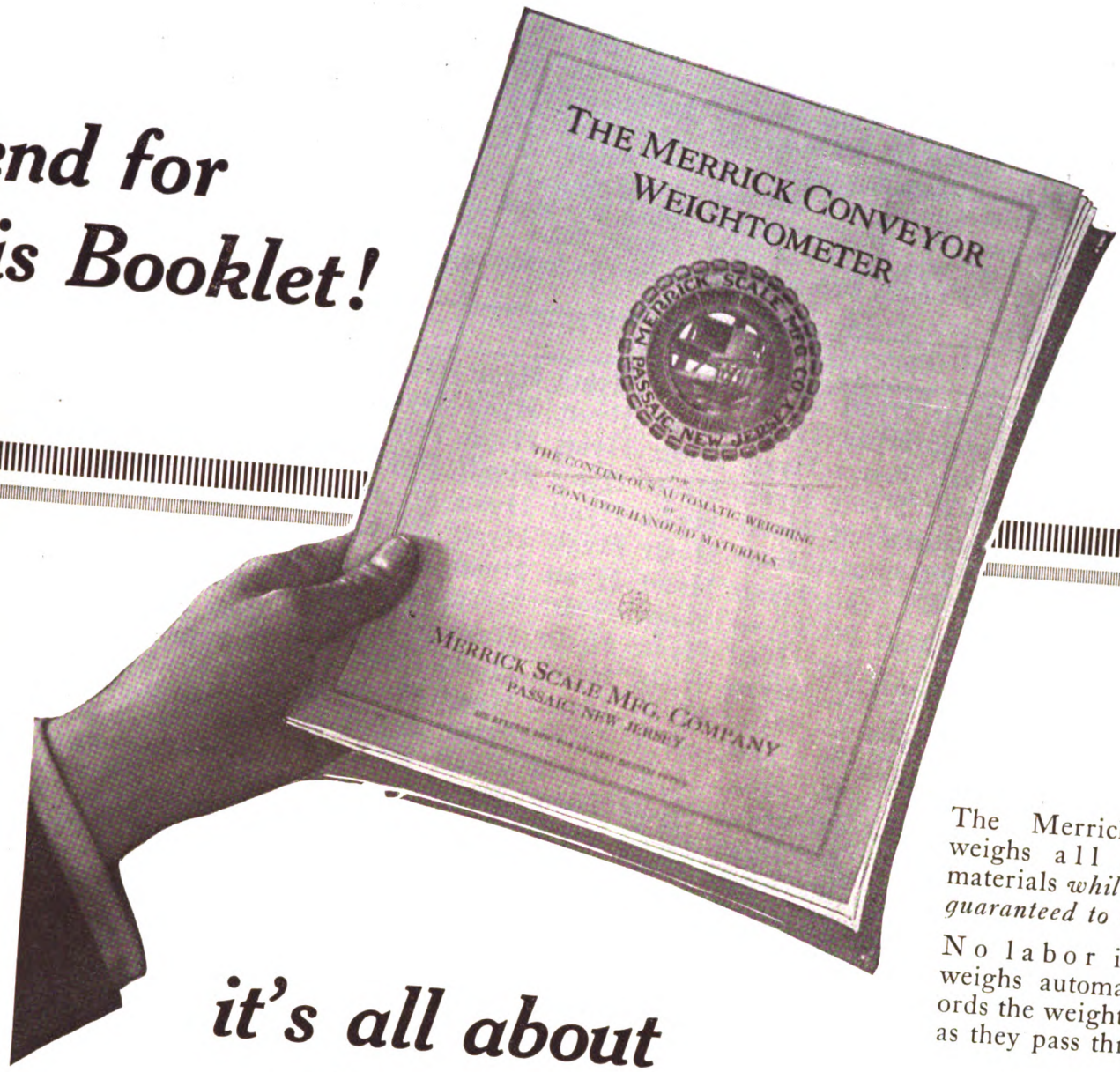
THE MARBLELOID CO., New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building....
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Floor.....Sq. Ft. Sanitary Base .....Lineal Ft. Wainscot..... Sq. Ft.

Our floors are (check below)
( ) New Concrete (*) Cement Finish ( ) Wood
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Name .....
Firm .....
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The Merrick way makes it easy for executives to investigate the relative merits of the Merrick Weightometer. Simply ask your Secretary to send for the booklet illustrated above, and you will have laid on your desk a book of illustrated installations, concisely and accurately described—a booklet that will enable you to tell in a few minutes just how much you can save if you handle Coal, Coke, Stone, Gravel, Sand, Cement Rock, Phosphate Rock, Phosphate Pebbles, Wood Chips, Sulphite Pulp Slabs, Fish and Fish Products, Ores, etc., etc.

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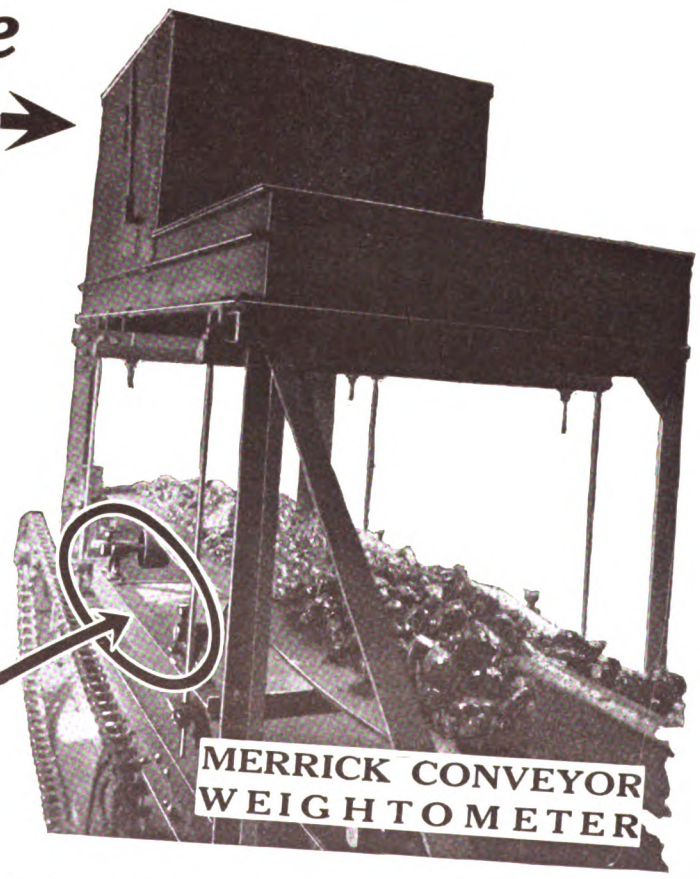
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The Merrick Weightometer weighs all conveyor-handled materials *while in transit* and is *guaranteed to be 99% accurate.*

No labor is required, as it weighs automatically and records the weight of the materials as they pass through.



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Is the Greatest Money-Saving Section of this Conveyor

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(*Continued from page 38*)

labor expense of piling the castings was so high that it offset the value of the space above the first tier. Eventually, lack of floor space necessitated the piling of the castings, and in order to do the work quickly and cheaply, it was necessary to obtain a piece of equipment to perform the operation of piling. The complete result and the new equipment is shown in figure 17. The results are a saving of floor space, increase by 200 per cent. in storage capacity for each foot of floor space, easy and economical piling (note that the placing of the second and third tiers was only slightly more expensive than the placing of the first tier) and a much more compact storage layout, thus eliminating a considerable amount of foot travel and trucking.

Frequently the same products have to be handled with different methods, due to their size and weight. For example, figure 12 shows the best method of piling long sheet metal; namely, electric hoist with slings attached to trolley monorails, operating over the piles. At the same time, figure 20 shows the best method of handling short sheet metal with a special finger electric storage battery truck, which picks up each pile and raises it or lowers it as desired.

Occasionally special machines have to be provided to take care of particular requirements, and figures 18 and 19 show such an installation in the paper storage warehouse of the Detroit "News." The paper is brought in on small dolleys running on industrial tracks and piled as shown in figure 18. A close up of the four-poster portable elevator is shown in figure 19.

While there has been waste in the raw material and finished product warehouses, there has also been waste of time and valuable overhead space in process departments and process stock rooms, and frequently a rearrangement of the storage of materials in process will save considerable valuable manufacturing space, and will also save time and money by reducing the idle time of production equipment, and the labor expense of handling materials in process. Figures 22 and 23 show the condition before and after the rearrangement of storing stampings in process in one department of the Seng Company, Chicago, where most of the material between machine operations is stored and handled in tote boxes. The tote boxes are made of steel and mounted on wheels, and contain steel stampings, of which there are possibly twenty different varieties. Figure 22 shows the condition which existed only a few years ago. The storing of the tote boxes with this method occupied considerable valuable manufacturing space, and there was always the difficulty in getting at a particular tote box when it was required. Often the confusion resulted in the loss of many man hours, and also in the loss of many production hours, by causing idle process equipment. It also kept the three men shown in the illustration continually busy, as it was frequently found necessary to shift eight or ten tote boxes in order to get at the one desired.

This condition presented a very serious problem to the executive, but it seemed impossible to overcome it with any ordinary methods, because there was no way to pile the boxes one on top of the other, and the

(*Continued on page 45*)

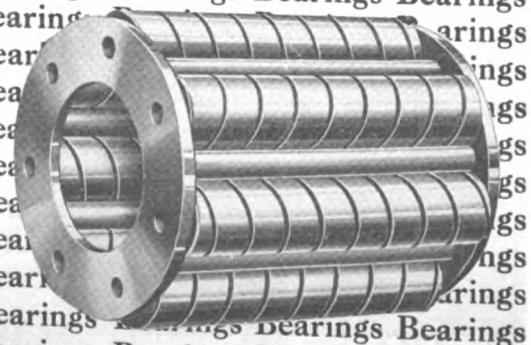
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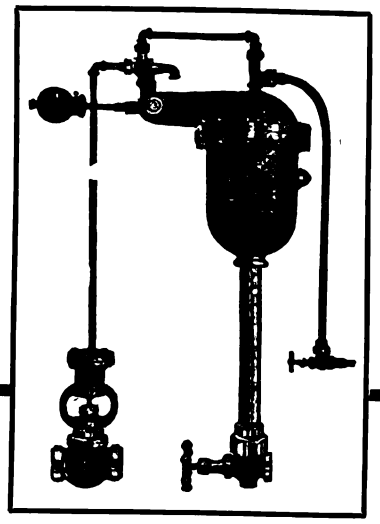
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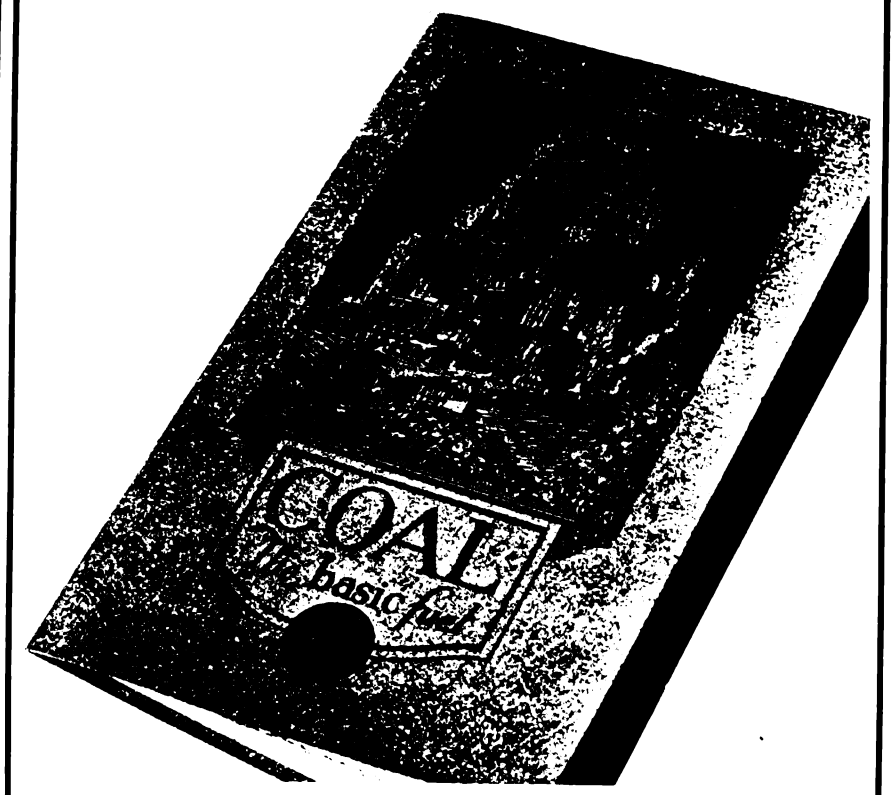
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Unless it's a Stuebing it isn't "Steel-Bound"



Stuebing Steel-Bound Platforms match the Stuebing Lift Truck in strength of build and adaptability of service. They won't wear down or wabble

You may think there are other "Steel-Bound" Platforms besides the one originated—and made *only*—by Stuebing.

For there are other platforms that somewhat resemble "Steel-Bound"—*in appearance!*

But you'll find, if you look closely, that none of these is made by Stuebing. And unless it's a Stuebing it isn't "Steel-Bound"!

It may have an oak top "just like the 'Steel-Bound'" and still be vastly inferior. For there are many grades of oak, you know.

It may have steel legs, and still grow weak and wabbly in service. It may have a binding of steel and still shatter to pieces under ordinary abuse.

For nobody other than Stuebing can build a "Steel-Bound" Platform the way the genuine "Steel-Bound" is built!

Stuebing tested every possible method of assembly, and the distinctive manner in which the top, legs and side rails are assembled in the "Steel-Bound" Platform was perfected by years of exhaustive, gruelling tests.

"Steel-Bound" construction is the *one best way* to build a lift truck platform—and it's covered by Stuebing patents!

Every genuine "Steel-Bound" Platform is identified by the Stuebing "Steel-Bound" trade-mark as a protection to you.

If you feel, as do the nation's leading industries—such as General Motors, Goodyear, New York Central — that "Steel-Bound" Platforms are just as essential to your lift truck equipment as Stuebing Lift Trucks, you will be sure to look for this Stuebing label (illustrated above).

For you can always be sure that *unless it's a Stuebing it isn't "Steel-Bound"!*

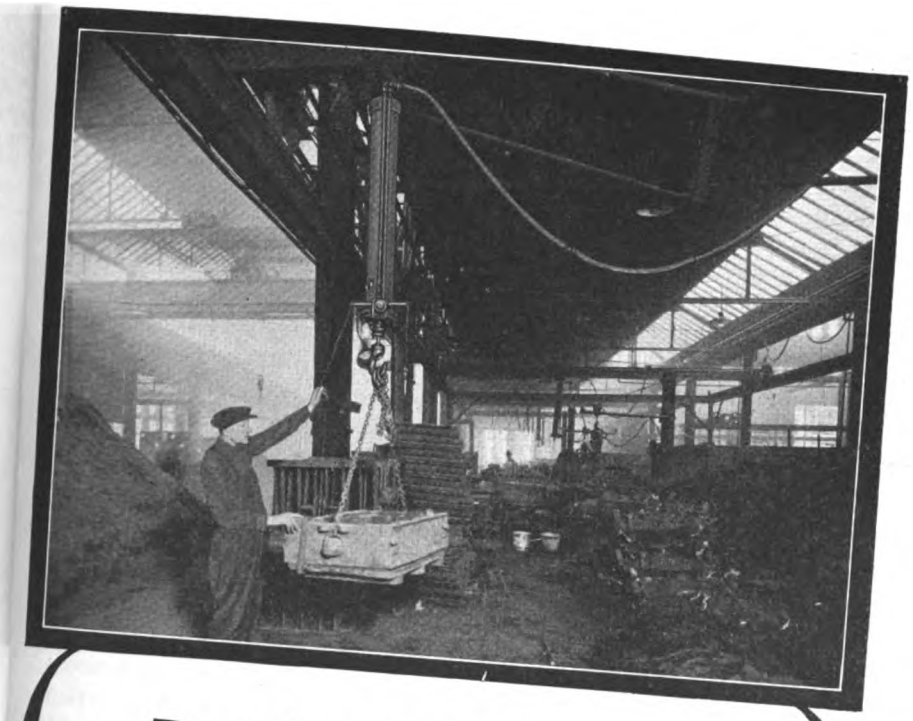
THE STUEBING TRUCK COMPANY
Cincinnati, Ohio; Montreal, Quebec
Branch Sales Offices in all Principal Cities

NO OTHER LIFT TRUCK IS BUILT LIKE A STUEBING!

StueBing
LIFT TRUCK SYSTEMS

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Do You Lose Money *Between* Machining Operations?

EVEN if your plant is equipped with the most modern production machinery, there is still a big chance for you to lose money ***between*** machining operations!....Why? Simply because you may not be ***moving*** your material with dispatch, or economy (i. e. low labor cost).



Curtis All-steel *Air* Hoists and Roller-bearing Trolleys lift and move any kind of material, quickly, economically and safely, making use of a power already available in most plants. They save time and energy and men—before, during, and after machining operations. With Curtis I-Beam Trolleys a 4000-lb. load can be moved by a 50-lb. pull.

Capacities up to 20000 lbs. and various types to meet your particular needs. Send for full information.

CURTIS PNEUMATIC MACHINERY CO.
1668 Kienlen Ave. St. Louis, Mo.
Branch Office:
536-S Hudson Terminal, New York City

"Lift it With Air"

CURTIS
AIR COMPRESSORS-HOISTS-TROLLEYS-CRANES
ST. LOUIS

311

(*Continued from page 42*)

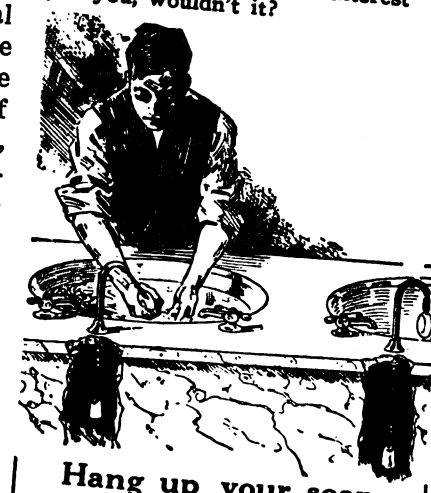
variety of the stampings only complicated matters. This condition had existed for many months, and much thought was given to the possibility of reducing the handling expense in this department, also to increase production by reducing the total hours of idle equipment. The final solution is shown in figure 23, which illustrates the sets of steel racks for the tote boxes, and also shows the portable elevator which is used to elevate the tote boxes into the racks. The construction of the racks is simple, consisting of angle iron panels with channel iron tracks, spaced to fit the wheels on the tote boxes. The head room in the space allotted for the storing of these materials was high enough to permit tiering the tote boxes four high, as shown, and the racks were built short (five boxes in depth), which was determined to be the right amount of storage space for each assortment. A space was allowed between each set of racks to permit the man in charge of the installation to get at any particular tote box when wanted, and also to make a complete physical inventory when required.

The result of this installation was a reduction in the space required for storage to one-fourth of that required previous to the rack installation. In addition, one man now takes care of the entire storage instead of three, thus making a saving in wages of two men. Tote boxes can now be taken from one operation, held for the length of time required, and immediately delivered to the next operation without any delay to production equipment, and at a moment's notice.

It is not only in the machine industries that better storage conditions and rack methods can be employed, but, as shown in figure 24, even in the textile industry economies have been effected, in the cost of handling goods by installing modern methods of storage. This shows the warp beam storage racks on the Monument Mills, at Housatonic Falls, Mass., which have overcome the difficulty of storing warp beams in process. It formerly required four or five men to handle these large warp beams, and it was impossible to pile them more than two high, and even under the best conditions there was frequently a large item of expense, due to damaged materials, where one

If we would save you 50% on the cost of the soap

used in your employees' wash rooms and would prove it to you, and at no expense to you whatsoever, it would interest you, wouldn't it?



Hang up your soap with a soap-holder

and you'll hang up a new record for low soap consumption.

To any user of our soap we will supply the fixtures free of charge as long as you use our soap, and we keep them in condition.

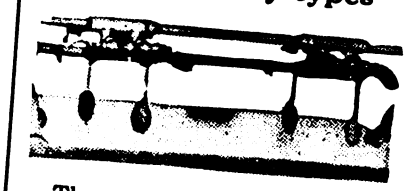
Free trial offer

We will send you fixtures to equip your washroom together with a sufficient amount of soap to give it a thorough tryout and remember it costs you nothing. Neither does it place you under any obligation to us whatsoever.

Cut washroom maintenance costs

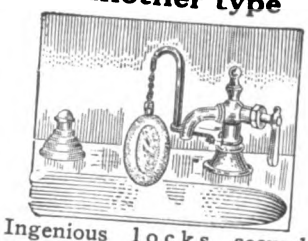
With the soap-holder—Soap cannot be carried away, thrown on floor, or left in water to become soft, mushy and unfit for use—it cannot break up when worn and clog drain or make the washstand untidy.

One of many types



These soap-holders are made in many different types and designs. They are made of brass, heavily nickel-plated, or of German silver and extra strong to resist tough usage.

Another type



Ingenious locks securely attach the soap to fixtures by means of an anchor imbedded in the bar of soap.
Where these fixtures are installed—every ounce of soap is used.

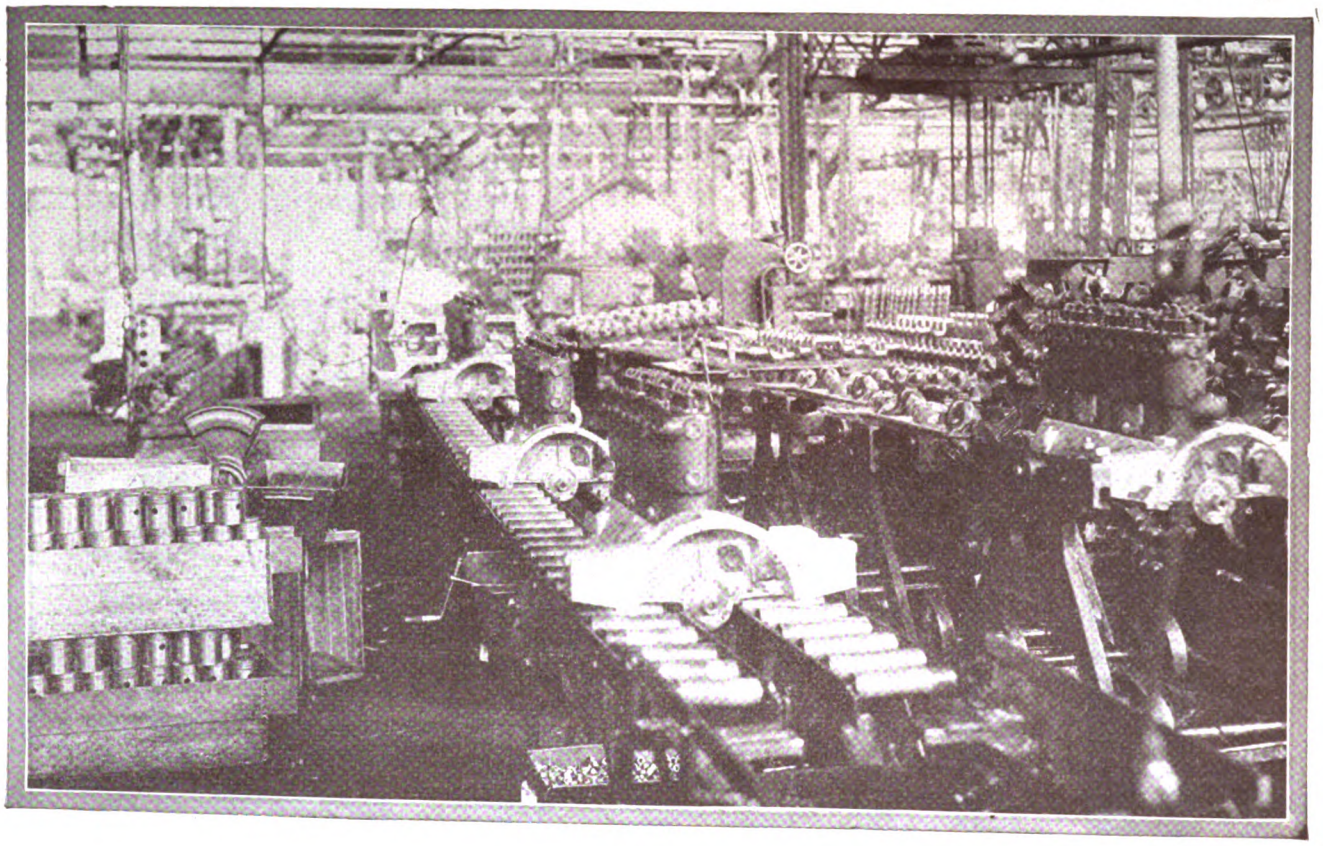
Write today for full details.

ANCHOR CORE ECONOMY SOAP CO.
136 West Lake Street, Chicago, Ill.

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spool would come in contact with the warp on another spool, and the possibility of dirt injuring the warp also presented a serious problem and a considerable loss. Now one man, as shown in the illustration, can handle the warp beams alone, lifting them into place in the rack by the use of an electric portable elevator, which operates off an ordinary lighting circuit. In the racks no spool comes in contact with another, and they are all conveniently spaced, thus it is impossible for one spool to damage the warp on another, and the savings made by reducing the damaged goods has greatly assisted in paying for the installation of the racks. In addition, better operating conditions exist, and considerable space has been saved in the storing of goods, and time and money have been saved in the handling of the spools in storage, and also there has been a saving in idle production equipment, as it is much easier with this system to deliver goods out of storage quickly when required.

Adapting gravity conveyers to machine shops



Simpler handling increased production here—and costs nothing

THIS Mathews conveyer has proved an easier and quicker way to assemble the parts used in the construction of automobile engines, crank cases, etc. Motors-in-process ride conveniently from start to finish on smooth rollers and gravity carries them free—no cost for power and no cumbersome or slow handling.

This is just one of many industrials in which Mathews conveyers have sped up material handling by solving a special problem. And each of these industrials has realized a 50 to 75% saving in handling costs.

Further economy lies in the fact that Mathews equipment is built to last. Many conveyers have been saving for their users over a period of from ten to sixteen years *without a cent for repairs.*

Mathews Conveyers Applied to Your Industry

Our engineers will gladly consult you on your handling problems. There may be one or many places in your plant or shop where Mathews conveying equipment can reclaim many hours of labor and speed up production for a fraction of the present cost. Our entire experience is yours for the asking, or, a catalog of facts will be sent upon request. Write us today.

Mathews Gravity Carrier Co.
157 Tenth St.
Ellwood City Pennsylvania

MATHEWS
SPEED ECONOMY
GRAVITY ROLLER CONVEYER

When writing advertisers please mention Industry Illustrated

While the majority of the illustrations have shown interior storage space, we must not overlook the possibility of increasing the storage capacity of the plant yard, and figure 25 shows how a crane, equipped with an electric magnet, has reduced labor costs and increased storage capacity by piling scrapped metal higher than could possibly be done cheaply by hand labor.

Each illustration of proper and improper methods of storage will probably bring to the mind of some executives the seriousness of his problem, and they are presented with the intention of pointing out to these executives the possible sources of financial and production losses resulting in their plants, which are due to inefficient storage methods that can easily be remedied by rearrangement, more up-to-date methods, or the possible use of mechanical equipment for piling.

A number of industrial plants are now faced with a serious storage problem because it is usually at this time of the year that maximum storage requirements are called for. Now, therefore, is the opportune time to install better methods, and to realize the many benefits that can be derived in this manner.

The subject of materials handling has been more or less limited to the elevating and conveying of materials, and most executives feel that when the subject of materials handling is spoken of, it refers to the use of bucket elevators and screw conveyors. This narrowing down of the subject has greatly limited their viewpoint. The writer here states his definition of what materials handling means to him, and if the plant executives will consider the matter in this broad way, they will quickly realize that they are vitally interested in all of its phases and ramifications.

The definition may be written thus:

"Materials Handling is the Science and Art of Conveying, Elevating, Hauling, Storing, Transporting and Handling Materials from one location to another."

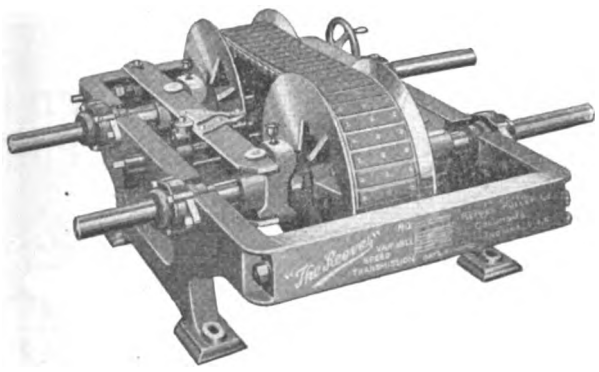
There are few industries in the country which do not have to handle materials into and out of the plants. Industrial executives, accordingly, should not turn their backs on the subject, as many of them unquestionably

(*Continued on page 49*)

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SPEED CONTROL

Through



"The Reeves" VARIABLE SPEED TRANSMISSION

A compact, mechanical device for application to any machine or conveyor on which variation of speeds are desired.

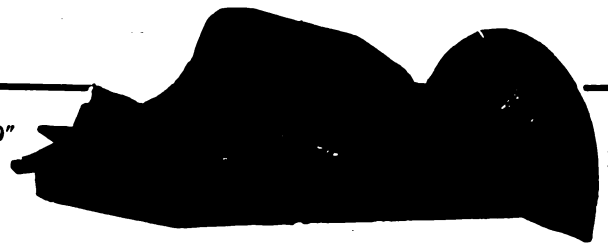
It enables the operator of the machine to secure exactly the correct speed for the material which is being manufactured. Any one speed may be maintained indefinitely or the speed may be changed as often as necessary. The flow of speed and the power transmitted is positive and steady at all times.

Equipped with complete ball bearings throughout. All bearings are dust proof and oil tight, and require lubrication only at long intervals.

Over 95% of the world's industrial plant requirements for mechanical variable speed control are now filled by "The Reeves" Variable Speed Transmission.

Investigate now. Write for catalog, L-44.

...VES PULLEY CO., Columbus, Indiana



...th 9" Width 18" Length 32"

...luminum Casting Replaced

With Pressed Steel Oil Pan

Here's an instance of how a large automobile manufacturer uses ...r services. They replaced an expensive, machined aluminum oil ...n with a G. P. & F. Pressed Steel Pan. Strength, utility, appearance ...ere not sacrificed—and the money saving is large.

If you use any quantity of aluminum, grey iron or malleable ...stings, or wooden parts—let us figure with you on replacing them ...ith Stampings or Pressed Metal Parts.

In most cases the saving is considerable—strength and utility ...eatly increased.

More than 1,200 workmen, 42 years specialized experience, capacity ... excess of 100,000 finished parts daily. 15 acres of floor space—huge factory for you—a service that manufactures in ANY quantity —and delivers WHEN and WHERE wanted.

G.P.&F.SERVICE

"KNOWING HOW SINCE '81"

We specialize in Drawing, Stamping, Punching, Spinning, Forming ...nd Blanking Aluminum, Brass, Copper, Sheet Steel, Tin Plate and ...heet Zinc. Also furnish estimates on Hot Galvanizing, Terne Coating, ...apanning, Tinning and Porcelain Enameling.

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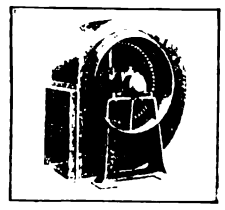
352-358 W. Ohio St., Chicago, Ill.

Where good fans are money makers

At least one of the fan and blower applications described here often many have a profitable application in *any* plant.

The principle—moving air—is simple; but the applications are endless. Fans are taking the place of hand trucking—by blowing materials through pipes. They are taking the place of direct radiation—by supplying pure air heated *or* cooled according to outside temperatures. They are making many products better and cutting production cost at the same time. So varied are the profitable uses of moving air that they can be only touched upon in limited space—but the interesting book "Moving Air" covers the entire range.

Are you losing time and profits by not reading it? The coupon below brings a free copy.

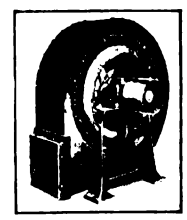


—in heating, ventilating, cooling, humidifying air conditioning, hot blast drying—

Fresh air is drawn from out doors by Clarage Fans; is heated or cooled and then blown to every part of factories, shops and offices. This system gives heating *and* ventilating at the cost of heating alone. In many installations the air is also washed and humidified by means of Clarage air washers.

In textile plants, cigar making and similar industries scientific humidity control is speeding production and improving the product. In paper mills heated air is used to dry roofs and stop the drip of condensation. Clarage multiblades are likewise used in many processes for hot blast drying. Clarage Ventilating Fans are described in catalog 52.

—for blast in forges, furnaces, cupolas—



Clarage Pressure Blowers are used to furnish blast for forges, oil furnaces, foundry cupolas, different types of industrial and chemical and metallurgical furnaces. Where higher air pressures are required, as in supplying air to gas generators, larger cupolas, furnaces, etc., the Clarage Type P. Blower gives air pressures up to 42 inches water gauge. Moderate pressure blowers described in catalog 22. Higher pressure blowers described in catalog 24.



—for removing shavings, dust, fumes and for pneumatic conveying—

Clarage Exhausters are paying dividends by removing gritty dust that would damage delicate grinding machinery; by removing fumes from paint spray rooms; by removing saw dust, shavings and blocks from wood working machinery. This type of fan has also found wide use in pneumatic conveying of light materials. Materials are handled at a fraction of the cost of trucking. Exhausters are described in catalog No. 111.

—for supplying forced draft to boiler furnaces—



Clarage Steel Plate Fans are used for forced and induced draft for boiler furnaces. Fans for this service are in most cases special applications, and there is therefore no field of fan application where the specialized experience of the Clarage engineering staff is of greater value. Clarage Type R. Fans are described in catalog No. 32.

CLARAGE FAN COMPANY

FANS :: ENGINES :: AIR-WASHERS

KALAMAZOO, MICH.

Clarage Fans are built in types and sizes for every service.

I. I.- 12 23.

CLARAGE FAN COMPANY, Kalamazoo, Michigan:

Please send a copy of the free booklet "Moving Air." I am particularly interested in .....

.....

Name **.....**

Address **.....**

Company **.....**

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The Cord Is Part of the Tool

Protect It to Keep the Tool in Use

The portable cord is the artery through which the power flows that keeps your tools productive. To avoid delays and accidents it must receive the same careful attention that is given the tool itself.

A **Reelite** will keep your light and power portable cords neatly coiled in its steel container, free from kinks, breaks or tangles. It will pay out the cord as needed and then retrieve it automatically when the job is finished. The action is similar to that of a window shade.

Reelites are built in all sizes—from a tiny one designed to handle 10 feet of lamp cord to the big Mogul Type that will take care of 125 or more feet of heavy power cable. There is a **Reelite** adapted to each and every one of your power or light extension requirements. When once installed they will soon pay for themselves in convenience, reduced cost of cord maintenance, increased production and elimination of accidents.

Write for Folder 314S describing the various types of **Reelites.** It will be sent free on request.

APPLETON ELECTRIC COMPANY

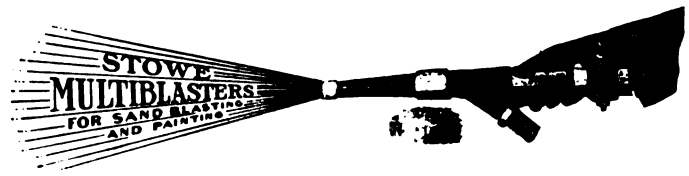
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CHICAGO

Reelite

REG. U.S. PAT. OFF.



The Gun that brings down the cost of painting and cleaning-

STOWE MULTIBLASTER outfits offer you a better, faster and more economical means of painting and sand blasting. This method consists simply of mixing paint or sand with compressed air and applying it to the surface by means of an especially designed nozzle. It has been used with noteworthy success in a wide diversity of industries.

The labor and time saved by the MULTIBLASTER may be gauged by the fact that one outfit will replace 6 hand workers on metal surfaces, and 18 to 30 men on wooden or concrete surfaces.

The MULTIBLASTER does a better job with less sand or paint. Positive and uniform distribution is assured by the fact that the paint is drawn into the spray by suction, keeping the ingredients stirred up. There is much less paint wasted as compared with the brush method.

MULTIBLASTERS require no tanks. Sand is syphoned from pit, barrel or pile—paint from any container.

There are several thousand MULTIBLASTERS in use, all sold subject to trial, and paid for.



"The Man Behind the Gun"
(COPYRIGHTED)

	Price	Weight lbs.	Hose Suction	Pressure In. lbs.
Standard Size Sand Blast	$30.00	8	1	80-90
Medium Size Sand Blast	18.00	6	¾	60-70
Bench Blast	15.00	3	½	40-50
Paint Spray	12.00	2	½	40-50

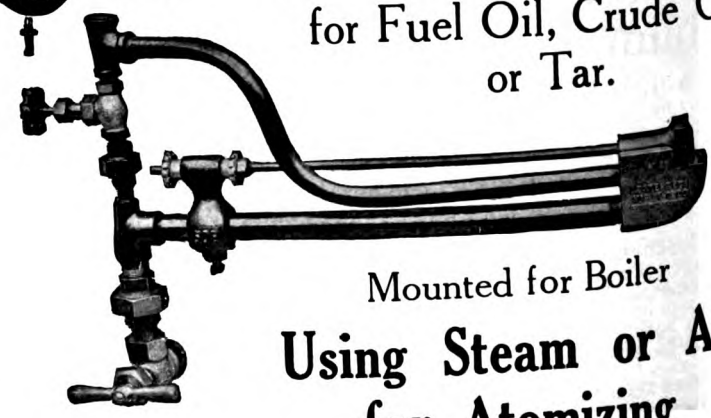
Prove its value before you pay for it. Any outfit shipped for 10 days' trial, via express or parcel post, ready for instant attachment to your air lines.

Geo. M. Stowe, Jr. Manufacturer

68 Forest Ave., Buffalo, New York

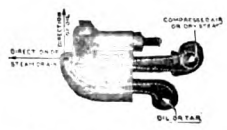
CALOREX Burners

for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



CALOREX Unmounted

Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

Write for catalog.

W. N. BEST Corporation

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There is nothing better than the Best

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Factory Maintenance and Quantity Production

are both improved to a surprising degree through the use of SPRACO Portable Painting Equipment and SPRACO Industrial Finishing Equipment.

Our booklet can help you.
Write for your copy today:
Department P-86

SPRAY ENGINEERING COMPANY
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Manufacturers of
Air Washing Equipment
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Park Sprinklers

Engineers for
Spray Cooling Systems
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Aerating Reservoirs
Air Conditioning
Gas Washing

TRADE MARK

SPRACO
BOSTON

(*Continued from page 46*)

ter materials handling methods it does not interest them, when it is to their advantage to investigate. Through inquiry, they will, it is reasonable to suppose, discover many places where better materials handling methods and equipment can be used to good advantage.

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

KEEPING THE WHEELS TURNING

American Pulley Co.
Chicago Belting Co.
Crescent Belt Fastener Co.
Diamond Chain & Mfg. Co.
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Fafnir Bearing Co.
Flexible Steel Lacing Co.
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WHAT DO YOU PAY FOR STEAM?

Bailey Meter Co.
Builders Iron Foundry
A. W. Cash Co.
H. S. B. W. Cochrane Corp.
Foxboro Co.
Jos. W. Hays Corp.
Merrick Scale Co.

The upper photo below shows a firebrick lining after a period of service. Lower one shows Plibrico Lining after same service.





Just one difference --- the lining

ONE difference—but what a vast difference it is!

In the upper photo, the crumbled side wall is an unanswerable argument against laid up firebrick; below, the staunch, *jointless* walls are a sermon for Plibrico.

Both photographs are of the same furnace, taken after the same amount of the same kind of service. And the result is no reflection on the quality of refractory used in the brick furnace. *The trouble started at the joints.*

Doesn't this illustration substantiate the conservative claim that Plibrico will outlast built up linings two to four times? Doesn't it prove that although Plibrico costs little more, it is worth at least twice as much?

Plibrico is the highest grade refractory in the most usable form—plastic, so that it can be pounded and molded into any required shape by anyone who can swing a mallet. When vitrified it forms a rock-like one piece lining that withstands temperatures to 3100° F.

It is described in the big book shown below—"Refractories and Furnace Design."

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Warehouse stocks in 60 cities—see phone books.

PLIBRICO
FURNACE LINING
REG. U. S. PAT. OFF.
JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

The coupon brings this **FREE** *book*



Jointless Fire Brick Co., 1154 Clay St., Chicago. Ind. Ill. 12-23

Please send me the 32 page booklet "Refractories and Furnace Design"—no obligation.

Firm .....

Address .....

.....

Att'n .....

At Last a Real BELT CUTTER

When you know the features of the New Detroit Belt Cutter you will agree that no belt user can afford to be without it. The knife arm lifts to make it easy to apply the belt. It squares a belt with perfect accuracy—fully guaranteed.

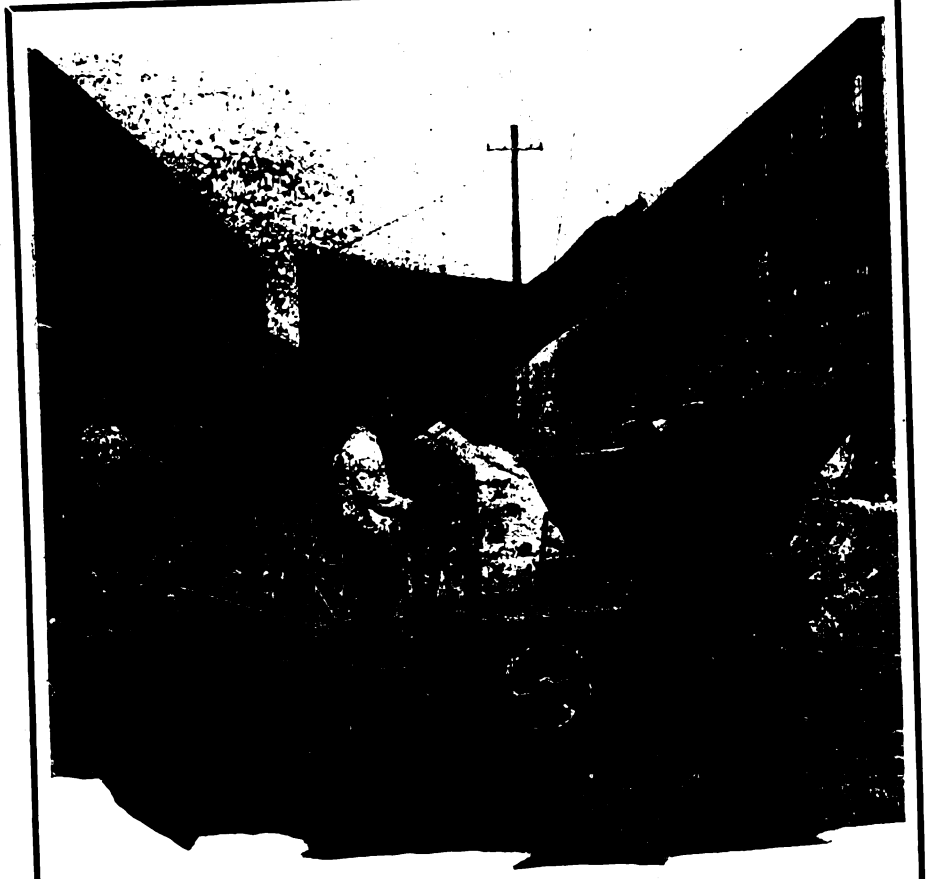
Made by the makers of "DETROIT" Belt Lacing and Closing Machines

Nothing has been spared to make it the most efficient device for its purpose. Made in two sizes—6" and 10". Write for folder. Order now if you want delivery within 30 days.



DETROIT BELT LACER CO.
Detroit, Michigan, U. S. A.
Branch Offices in Large Cities Licensees in Foreign Countries

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Cuts the Cost of Reclaiming Coal

USED in conjunction with other equipment or used alone, the Scoop Conveyor is a mighty handy machine to have around for reclaiming or transferring coal from storage pile to boiler room.

It is ideal for loading small hand cars, electric dump trucks and similar equipment which in turn carry the coal into the boiler room. When the coal storage is not too far from the plant, two or more conveyors can be placed in tandem style, one feeding to another, and thus by feeding one machine the coal is delivered direct to the boiler room.

Well balanced construction permits extreme portability so that the machine can be easily moved about the yard.

Of course the same machine is used for unloading cars, storing coal and loading trucks or wagons. Any kind of coal, coke, ashes, sand, gravel, stone, etc., can be carried on the machine.

Thousands of users have found the Scoop Conveyor an extraordinary good investment.

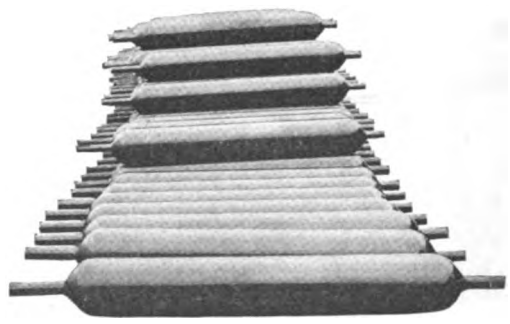
Write for Catalog No. 158

Portable Machinery Co.,

PASSAIC, N. J.

ask any user

THE SCOOP CONVEYOR

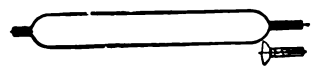


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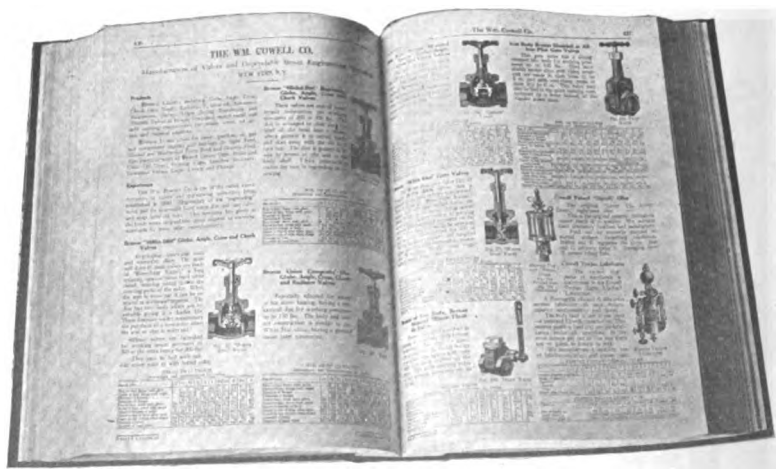
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Keeping the Wheels Turning

(Continued from page 13)

be oiled regularly, as they un out of oil and cause . Clutches require sim- tention and should be ad- so that they work easily. t and loose pulley coun- ts, the belt from the main ould be lined up so that not creep over onto the ulley. This might cause dent to the operator if he ed to have his hand on chine.

n machines are installed erecting shop with a high and an overhead crane, st way to drive the ma- is the individual motor This is expensive in first nd is not always feasible. s case, a steel or wooden harness work can be an- l to the wall and on this, sual countershafts and line can be hung. In or- at the operation of the may not be interfered these machines and their ead harness work should t out into the room any er than is necessary.

w that most motors are upside down on the ceil- hey are rather hard to put ace. An excellent method sing them to the ceiling is ing a portable elevator or g machine on which a high e has been built, or else if are many motors to in- the platform of the ele- can be turned upside down at it will go up higher.

hen a motor burns out, as ionally happens, the ad- ility of using motors of lard size throughout the is driven home. If a re- ment can be made with an ically similar motor, it is mparatively easy matter to e the change because pulley and length of motor belt ain the same. If a different motor is installed, pulleys have to be changed and or belt lengthened or short- l as the case may be.

is well to remember when ning belt drives that nar- thick belts are better than e thick belts. With a belt- table, the proper width and kness can be selected, but it good idea to use a belt a e too big rather than one a e too small.

everal kinds of belting can used in the average plant, as leather, woven fabric, canvas and rubber. Each of these have characteristics which make them particularly well fitted for some special jobs, either on account of the conditions of the drive itself or by the exterior conditions such as moisture or heat. Inasmuch as leather is more extensively used in general shop use, it will be treated more in detail. The quality of leather in a belt and the method of joining the various pieces of hide together has an important bearing on the service which can be expected. It is important therefore that motor drives and all main drives should be of first grade belting.

For maximum economy, the speed of belts is variously given as between 4,000 and 5,000 feet per minute. Many drives cannot take advantage of this economy and therefore require wider and thicker belts than if the linear belt speed were increased.

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Correct belt tension is very important. When a belt stretching machine is available, each new belt should be stretched before installing it. If this is correctly done, this method eliminates at least some of the time required later on to tighten the belt after it has stretched in service. Important belts should be taken up every couple of weeks until they are fully stretched. Good belt dressing applied now and then will sometimes make a belt pull as it should. However, if a drive requires continual belt dressing something is wrong.

A great many belts break at the lacing, especially when laced with metal lacing. Care in hammering the metal lacing into the belt will lessen this trouble. Up and down belts on machines where the operator shifts the belt, such as stepped cones, should be laced with pigskin in the good old fashioned way, or else if metal lacing is used, the ends of the lacing should be carefully turned in and pressed into the belt. A soft pigskin or a piece of soft, heavy string should be used to join the metal lacings on these belts so that there will be no chance of cutting the operator's hands. Machines equipped with belt shifters do not require any such care.

A power driven belt lacer will soon pay for itself in the millwright department, as it is much faster and will lace large belts easily. Each gang should have as part of their equipment a hand belt lacer so that they won't have to return to the millwright department to lace a belt.

Because motor belts run at high speed over rather small motor pulleys, they should be endless, that is, glued together. A board with metal clamps is required if a good job is to be done. The length of the lap depends on the width of the belt, both ends are shaved down evenly and are glued together and held in place on the board until the glue has set.

The subject of crossed belts comes in for attention when one thinks of power losses, because they consume more power than open belts. If a room has a good many intermittently used machines driven by crossed belts from the main line to the countershafts, it may be worth while to put open belts from main line to countershafts and crossed belts down to the machine. This will save power while the machines are idle. This, of course, should not be attempted on stepped cone machines. Sometimes there are places where much more than a majority of the machines are running with crossed belts; if this majority is large, it may be advantageous to reverse the direction of rotation of the main line.

Rolls of new belting in the millwright stockroom can be mounted on rollers in a rack built to fit the various widths of belt. If the rack is at the end of the room, the belt can be pulled out on the floor, measured and cut to length. Where a fireproof oil storage room is provided, it is usually to draw small quantities of oil and grease at frequent intervals.

Pulleys of pressed steel are largely used on account of their strength and light weight. With high speed shafts and small diameter steel pulleys, a fine installation is effected. Where an absolutely true surface is required, or where the diameter must be exact, cast iron pulleys are used.

The "CUB" will load it easily



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It is known for its reliable performance in the loading of coal, gravel and similar materials throughout the entire country. It is a Link-Belt GUARANTEED Product. It knows no superior in construction, performance or loading capacity.

Price—$550 f. o. b. Philadelphia or Chicago. 2-H. P., 2 or 3 phase, 60 cycle, A. C. motor, 21-ft. conveyor length, 18-inch wide belt assuring large capacity, belt guaranteed against cutting or fraying; wide loading hopper at foot of conveyor is hinged—easily and quickly opened. So simple and sturdy anybody can run it. Order at once for prompt shipment.

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n pulleys, though not gen- used in modern machine are good for special serv-

re are four types of drives n transmission work. The universally used is the belt and we have therefore d it at considerable length. a belt drive is not suitable, ain drive, gear drive and drive are used.

ain drives are especially de- le for motor drives where otor is hung from the ceil- r overhead harness work. ain drive on centers of less three feet makes a fine in- tion and where space is ed, is very economical. The l type of chain used on this ce is the type with teeth cut e chain itself. These teeth with teeth cut into the cket. The motor should be nted on slide rails so that can be taken up when the n stretches. A sheet iron rd around the chain also es as a reservoir for soft se and a chain running ough this grease in the lower t of the guard will last much ger than if it were greased y occasionally, as the chain a tendency to throw off ex- sive grease. When speeds slow on chain drives, or en the service is severe, a ler type or cast link type of ain may be used. These types e usually used on conveyors or ives from one shaft to an- ier on heavy machines or uipment. These chains, espe- lly the roller type, should be ed or greased occasionally, t as they are often installed places hard to get at, they rely receive the lubrication ey should get.

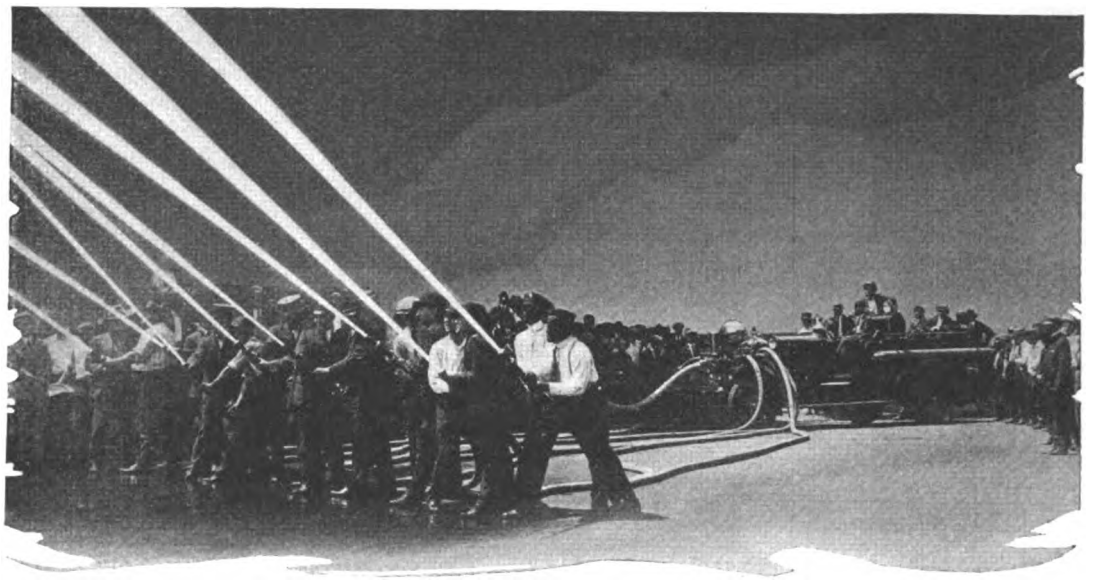
There are two general types gear drives; spur and bevel. machines, these drives are iversally used, but as far as e millwrights are concerned, ey are not usually used except heavy drives on large equip- ent. Gear drives must be at rrect center distances if they re to wear for the length of me they should, and they re- uire greasing with heavy rease.

For very long drives or for rives exposed to the weather, ope drives are very good. They re often used for transmitting ower at right angles. How- ver, as electric motors are be- coming more and more univers- lly used, the necessity of us- ng long or outdoor drives is radually decreasing.

With wooden floors, machines may be easily bolted to the floor. Concrete floors, however, make it necessary to use an expansion shield or wooden plug so that lag screw will hold firmly. An electric or air driven hammer is almost a necessity if many machines are to be fastened, as quite a large sized star drill has to be used in order to get a hole big enough for the expansion shield. Sometimes the floor is not perfectly level, and in this case, each machine should be carefully leveled up. Common shingles make an excellent wedge for this work. After the machine has been bolted down, the parts of the shingles sticking out can be cut off with a chisel. Several methods are used for lining up machines with the main line. A steel tape, or a hardwood measuring stick are two methods largely used. Proper lining up is very important, as bearings will wear on one side, and belts will not run true if machines are not lined up.

Belt, roller, gravity and elevating conveyors are all used

SKF



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TWELVE streams are possible from this fire engine of 1400 gallons per minute capacity. Imagine the headway a fire would make if the pumps on this engine broke down due to bearing trouble—if all the twelve streams failed at one time.

To guard against the failure of this large fire fighting unit when responding to an alarm and when fighting the flames, Skayef self-aligning ball bearings are used on the jack shaft of the chain drive for propelling the engine and on the pinion shaft of the pump drive.

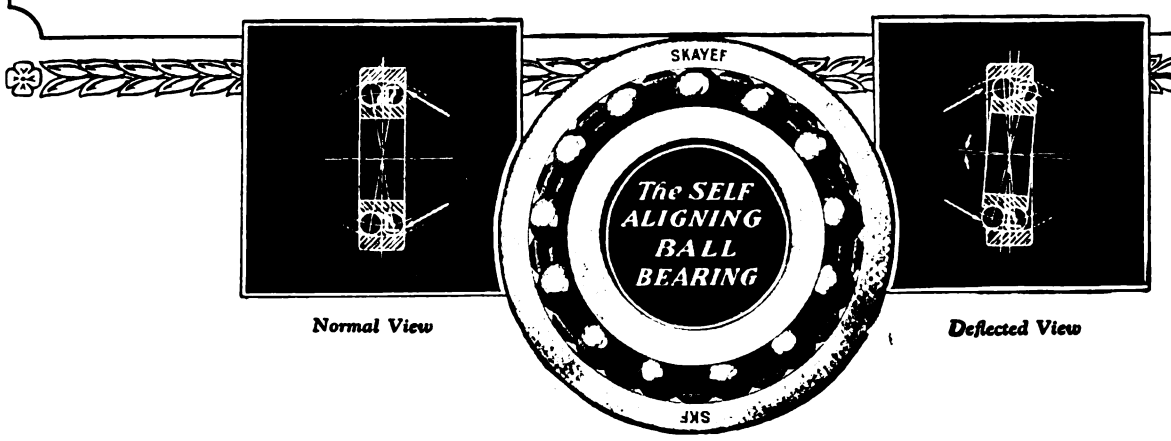
Made of chrome alloy steel hardened uniformly throughout, this type of bearing has great endurance. Furthermore it develops no appreciable wear in service even under conditions of misalignment which would cause plain bearings to bind, heat and ultimately fail.

Because of their stamina and precision SKF marked ball bearings are invariably preferred by experienced users on machinery of all kinds. Our engineers will gladly submit recommendations for applying ball bearings to your machines.

THE SKAYEF BALL BEARING COMPANY

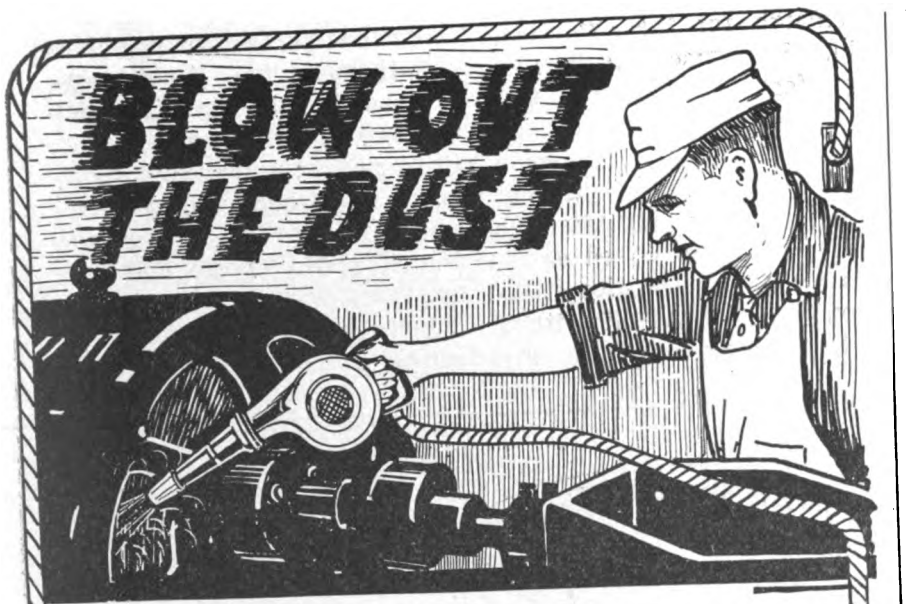
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Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

Weighs only 6 lbs. Complete in itself and requires no expensive installation or equipment. No condensation as with compressed air. Attached to any light socket.

The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories, and every line of industry.

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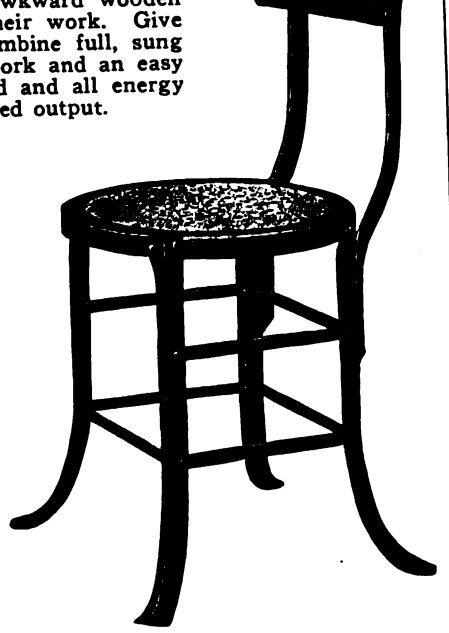
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for handling materials throughout the plant. Moving and wearing surfaces require oiling and greasing if they are to continue to give service. These conveyors frequently pass through rooms containing more or less dust and bearings will collect this and in time become ground out. Conveyors are installed to replace human labor, but don't let your desire to cut down the cost of handling keep you from taking proper care of your handling equipment. Coal conveyors are very important, so that spare parts should be kept available. When several months' or years' records have been kept of the spare parts required to keep conveyors running, those parts should be kept in stock. Coal handling equipment, from the crusher under the cars all the way to the stoker on the boiler, must operate every day under all conditions of cold and wet weathers, and it is therefore advisable to have the daily inspection cover this equipment so that small defects can be fixed before they get serious.

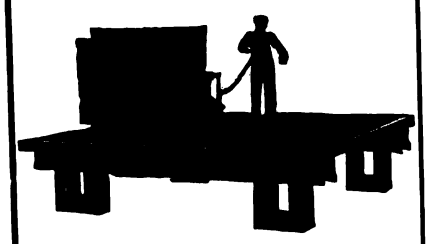
A very important item in the inspection of equipment is elevators. This inspection of elevators will include the electrical as well as the mechanical parts. The millwrights as a rule take care of everything connected with the elevator, except the electrical part. The machine should be oiled daily, and worn or broken parts should be replaced at once from the spare parts kept in stock. In this way no elevator will be out of commission very long. If all the elevators are working to their capacity during the day, any repairs, even of a routine nature, should be done in overtime. Cables will become frayed gradually as they wear, and they should be replaced when six strands are broken. The various factory and insurance inspectors will insist on this, but it is best to play safe and if cables go bad at any time, they should be replaced at once, and not wait for official instructions. Safety devices are designed to hold the car, even though the cables should break, and they, therefore, should be carefully inspected periodically. Every year the guides for the car itself should be lined up. Running heavily loaded trucks onto the elevator tends to throw the guides out of line and sometimes loosens the bolts holding the guides. In this case it is neces-

(*Continued on page* 56)

Cost Less-Weigh Less

and Live Longer

No weight
except where
weight is needed



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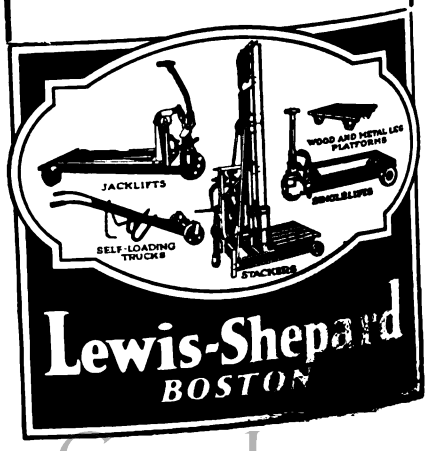
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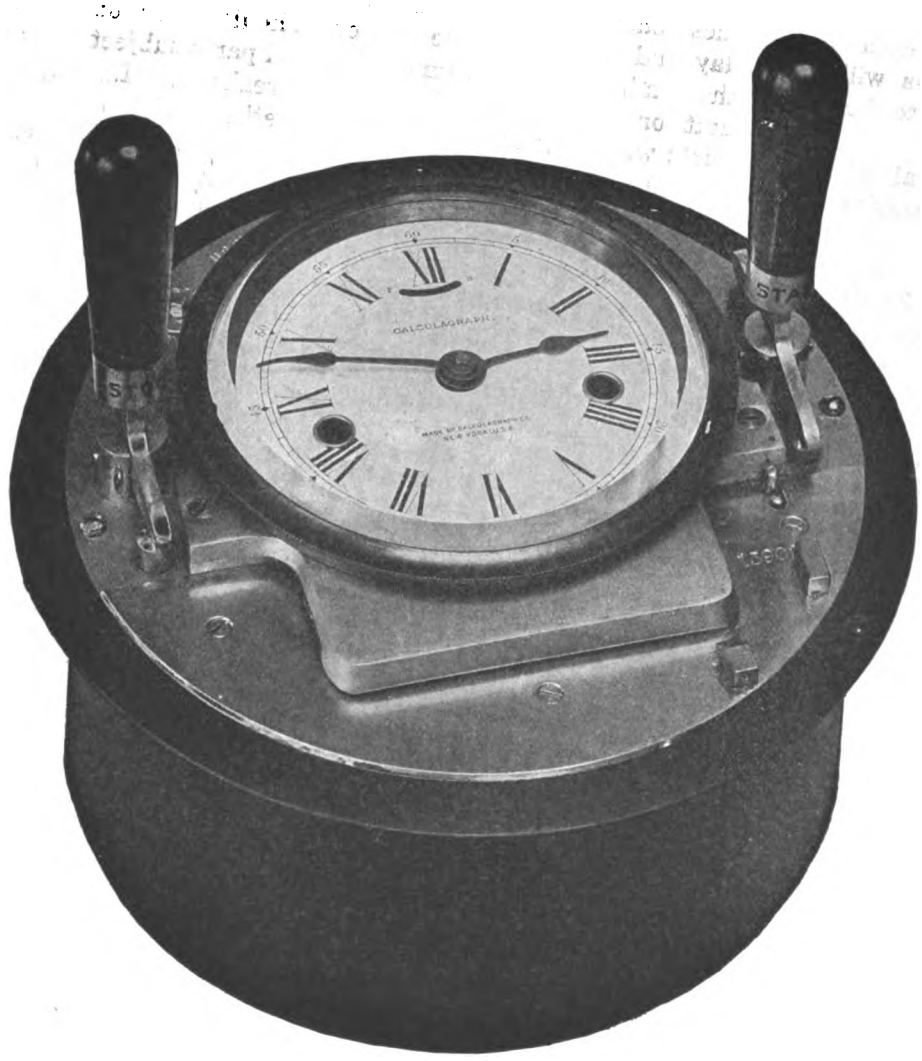
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Unlike the farmer, much of this could have been done by machines.

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Think this matter over. If you want to save time for your operators, time clerks and payroll staff, write for our booklet "Elapsed Time Records."

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(*Continued from page* 54)

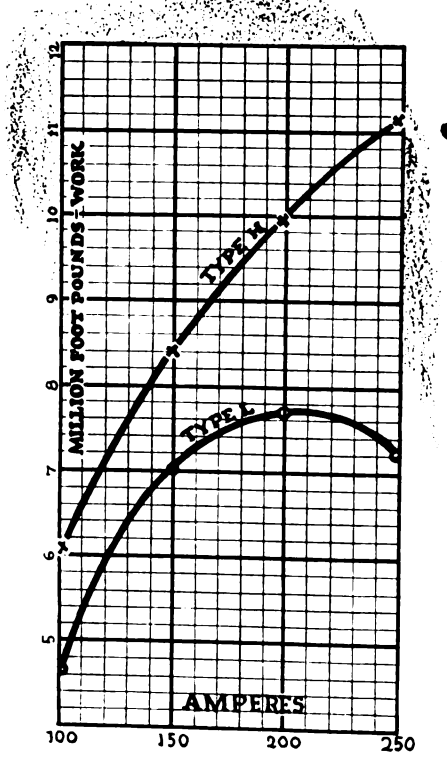
sary to change the location of the bolts or else grout long bolts through the wall. The weight guides are not subject to the same side thrusts as the others, but they should be lined up when doing the others. Elevator gates and doors are dangerous unless they operate properly and should be repaired immediately when they become damaged. The tinsmiths will take care of any damage to that part of the door.

Cranes of several different types are used throughout the plant, each one requiring individual attention. The large overhead cranes which serve the big erecting shops and foundries are the most important, and these should be inspected every day and a report made out on the condition of each important unit on the crane. These reports will show the condition of wearing parts, and these can be replaced long before an actual break occurs. Some minor repairs can be done while the cranes are operating. As in the case of other important units, the spare parts stockroom should have on hand any and all parts subject to hard wear or breakage. Lifting cables, together with their blocks and drums, should be inspected and kept in good order. The running gear is not so important as the lifting mechanism because a small break wouldn't cause as much damage. Nevertheless, it should be carefully oiled and watched. The operator usually oils and greases his own crane so there can't be any alibi in case of lack of oil. The beams and rails should be lined up every six months to a year. If the loads are light, the rails don't pull out of line much. Small cranes and jib cranes are not so important, but a little time given to inspection and care will be well invested. The chances of an accident are also lessened.

There are two ways to guard machinery and equipment. First, guarding to standard specifications which are laid down by the insurance companies. By this method of guarding, a substantial reduction in the compensation insurance premium is made. Second, guarding to prevent the average accident. This method is of course much cheaper in first cost and if well carried out will eliminate almost all accidents. A great many plants, especially the larger ones, have found that it is good policy to guard every piece of machinery so well that it is almost impossible for men to get hurt. Even under these conditions, accidents do occur occasionally, and when an investigation is made and a defect found in the guard, that defect is immediately remedied so that same accident cannot happen again. The method of installing certain drives on equipment affects the safety department's work so the everyday work of the millwrights is tied up with the subject of guarding. All of us want to make each job as safe as possible, and by striving and working toward that end, much has been and much more will be accomplished.

While conditions in industry and trade remain highly irregular, there is little change in the volume of industrial employment or in wage scales, nor is the average of wholesale prices much altered by the individual fluctuations from week to week. —(*Guaranty Survey.*)

Make Each Ampere Do 25% More Work



WHEN you consider industrial tractors, don't be satisfied with good results. Get the best. Why accept 4¾ million foot-pounds of work when you can get 6 million?

Look at the curves! The full-grown one shows the work produced by the new Mercury Type H internal gear tractor for various power inputs. See how it towers over the other curve representing the work you can get from the same energy expended in the best of the conventional worm drive models.

Think what this 25% "plus" work would mean in your own case—the ability to haul more trailers on each trip—to load each trailer more heavily—to operate for a longer period before recharging the battery.

And in addition to the important saving in cost of operation, this increased capacity for work usually produces multiplied economies through the speeding up of your whole material handling program.

How The New Type-H Makes This Possible

Introduces a balanced internal gear drive of entirely new design, eliminating the friction losses inherent in the worm drive. This results both in low operating cost and an absolute minimum of upkeep for the "power plant."

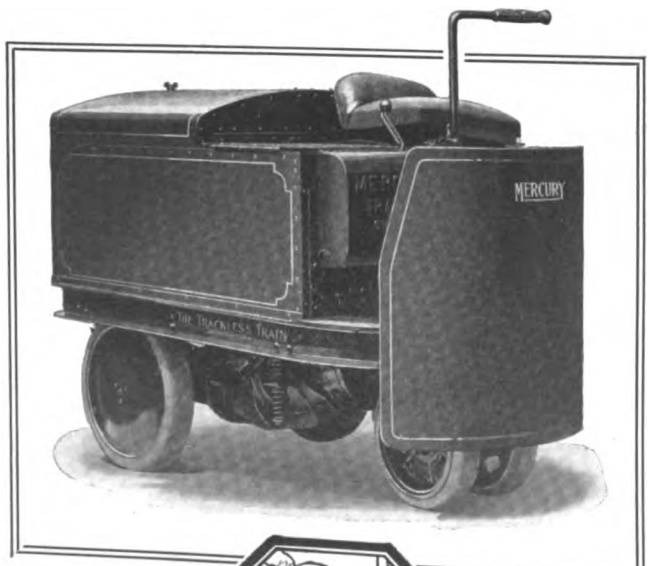
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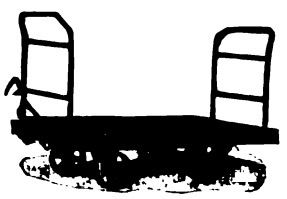
1. Special safety features effectively insuring against danger, even in the hands of inexperienced workmen.
2. Drum type controller of special design having long life, dependability, simplicity, ease of inspection and adjustment.
3. The exclusive Twin-3 front wheel assembly combining full spring suspension with the short turning radius of older 3-wheel models.
4. Frame of channels and angles hot riveted to combine maximum simplicity, rigidity and strength.

Fleet Owners

The Mercury organization pioneered in the field of electric industrial tractors, and for more than 8 years has made such tractors and trailers exclusively. It is therefore not surprising that a preponderance of all the large installations are 100% Mercury. A few of the large fleet users (over 10 machines) are the following:

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American Radiator Co.
Armour & Co.
American Window Glass Co.
General Electric Co.
Endicott-Johnson Co.
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United States Government
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Kewanee Boiler Co.
Eastman, Gardiner Lumber Co.
Standard Oil Co.
Union Stock Yards & Transit Co.
Pennsylvania Railroad Co.
Sears, Roebuck & Co.
Illinois Central Railroad
Lehon Co.
Morris & Co.
Swift & Co.
Miller Rubber Co.
Chicago Tunnel Co.
Chicago Union Station Co.
Chicago Burlington & Quincy R.R.
New York Central System





Trailers

And to complete the "Trackless Train" there are Mercury trailers of just as distinctive merit as the tractor. There are various designs for special purposes, but the A-310, illustrated above, is an all-purpose trailer which meets most all ordinary industrial conditions.



Mercury Manu ring Company

4112 South Halsted Street *Chicago, U. S. A.*

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1.—Showing interpreter at office taking application for service from foreign born ent, who cannot speak English, and transmitting same on Telautograph to Credit Shop Departments. These instruments are shown mounted upon a temporary ter while moving office to new location.



g. 2.—Showing employees, examining records to clear credit on applications taken as own in Cut 1, which records on instruments both at main office and shop.



Fig. 3.—Showing operator at shop making up orders transmitted by Telautograph after credit has been passed. There is also shown on the right telephone order table at which applications for gas and electric service, complaints and leaks are taken.

RECORD OF SHOP ORDERS

Transmitted by the Telautograph January 8, 1923, to show time between actual receipt of order and execution of same. This does not include leak and miscellaneous orders received by telephone at shop.

Telautograph Nos.	Nature of Order	Application made by Consumer	Credit Passed	Further Credit Investigation	Order Given to Bill Jones	Bill Jones Arrived at Premises	Elapsed Between Taking of Appl. and Arrival of Bill Jones Hr.	Min.	REMARKS
				TIME					
"A" Machine									To be done 1- 9-23
1	Spl. Test	8.49	....	....	....	....	..	..	Bookkeeper only
2	G	9.20	9.21	....	....	....	..	..	
3	G	9.47	9.48	9.57	11.08	11.15	1	28	
4	Canceled								
5	Sales	10.00	10.39	....	12.00	1.35	3	35	Welsbach heater
6	E	10.14	10.15	....	12.00	1.00	2	46	
7	PS	10.17	....	....	11.21	1.35	3	18	CGI
8	Set G&E	10.18	10.19	....	12.00	5.05	6	47	
9	SG&E	10.19	....	....	12.00	....	..	..	To be done 1-15-23
10	Void								
11	G&E	10.25	10.26	....	....	....	..	..	To be done 1-20-23
12	ST	10.30	....	....	....	....	..	..	To be done 1- 9-23
13	G&E	11.00	11.01	....	12.00	1.30	2	30	
14	Spec. Elect.								
15	E	11.15	11.16	....	....	....	..	..	To be done 2-20-23
16	PS	11.18	....	....	12.00	1.50	2	32	
17	Complaint	11.20	....	....	12.00	4.00	4	40	
18	PS	11.20	....	....	12.00	5.20	6	00	
19	ST	11.21	....	....	....	....	..	..	To be done 1- 9-23
20	ST	11.38	....	....	....	....	..	..	To be done 1- 9-23
21	G&E	11.37	....	....	11.40	....	..	..	To be done 1-10-23
22	G&E	11.40	11.41	....	12.00	1.45	2	05	
23	SG&E	11.42	....	....	....	....	..	..	To be done 1-10-23
24	SG&E	11.45	....	....	12.00	3.00	3	15	
25	G&E	12.02	12.03	....	12.10	2.05	2	03	
26	Spec. Elect.								
27	Set G	12.19	12.30	....	2.42	4.00	3	41	
28	Set G	12.30	12.31	....	12.40	4.20	4	00	CGI
29	G&E	12.34	12.35	....	2.42	2.50	2	16	
30	PS	12.40	....	....	6.15	8.15	7	35	Wrong address
31	PS	12.40	....	....	3.00	3.40	3	00	
32	AR	12.45	....	....	....	....	..	..	To be done 1- 9-23
33	AR	12.47	....	....	12.50	3.20	2	33	
34	PS	12.48	....	....	....	....	..	..	To be done 1- 9-23
35	SG	12.50	....	....	2.42	....	..	..	To be done 1-15-23
36	G&E	12.56	12.56	....	....	....	..	..	To be done 1-10-23
37	ST	1.00	....	....	....	....	..	..	To be done 1- 9-23
38	Leak	1.40	....	....	1.50	2.30	..	50	
39	AR	1.46	....	....	....	....	..	..	To be done 1- 9-23
40	G&E	1.53	1.54	2.06	....	....	..	..	Bookkeeper only
41	G&E	2.06	2.07	....	3.27	4.15	2	09	
42	Spec. Elect.								
43	G	2.46	2.47	....	4.14	5.00	2	14	
44	PS	2.50	....	....	3.48	5.20	2	30	
45	ST	5.10	....	....	....	....	..	..	To be done 1- 9-23
46	ST	5.11	....	....	....	....	..	..	To be done 1- 9-23
"B" Machine									
1	SG	8.35	....	....	9.25	9.30	..	55	
2	PS	9.03	....	....	10.03	1.25	4	22	
3	G&E	9.09	9.10	....	10.23	8.30	..	..	Picked up by Bill Jones before disp'd
4	SG&E	9.10	....	....	10.23	9.30	..	20	
5	SG&E	9.25	....	....	9.55	10.30	1	05	
6	G&E	9.39	9.40	....	10.30	10.45	1	06	
7	SG&E	9.50	....	....	....	....	..	..	To be done 1-15-23
8	PS	10.00	....	....	....	....	..	..	To be done 1- 9-23
9	SE	10.24	....	....	11.10	11.20	..	56	
10	Void								
11	SG&E	10.40	....	....	....	....	..	..	To be done 1-15-23
12	Spec. Elect.								
13	G&E	10.48	10.49	....	12.10	2.30	3	42	
14	Leak	10.52	....	....	10.55	....	..	..	St. leak—Ref'd to Street Dept. 1 p.m.
15	SG	10.58	....	....	12.00	2.45	3	47	CGI

The Syracuse Lighting Co.

with Telautograph Service

Reduced the time *on completed operations* from two days to two hours and forty-eight minutes!

Rapid and accurate transmission **of orders is the secret of this Revolution in handling Shop Orders and Operation!**

Your Production can be speeded up by this fast Transmission of Reports. Just ask us about it—no obligation—ever.

We will send our booklet—or our man.

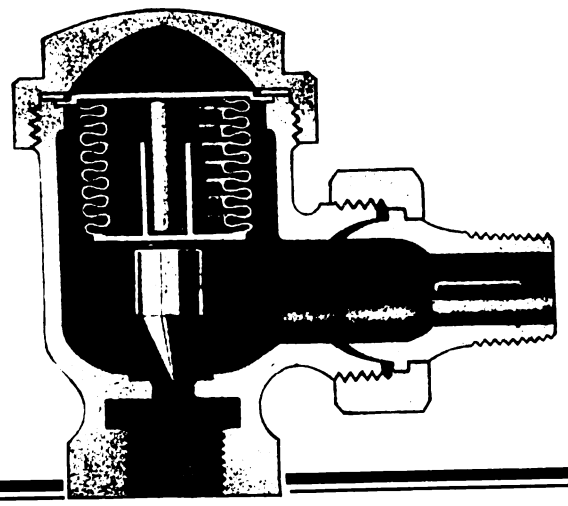
TELAUTOGRAPH CORPORATION

448 WEST 37th STREET NEW YORK CITY

Branches in 35 Cities **Service in 120 Cities**

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Making 100% Heating Installation EFFICIENT



With coal at present high prices, heating systems should be judged on the *saving of fuel* effected. And in order that it may operate at 100% efficiency as a whole, it must be properly trapped.

All radiator traps are not alike. To be positive that the condensate will find immediate egress, install the

Radiator Trap

SARCO

For instantaneous, positive, reliable action, the Sarco is in a class by itself. A very small quantity of condensate in the trap cools the thermostatic element, causing the vapor in the drum to return to its liquid state. This immediately restores the vacuum in the vapor chambers which in turn causes the element to contract and open the valve, discharging the water and air to the return. Steam following, at once reverses the action, closing the cone valve again.

The total lift of the cone valve from its seat, about ¼", permits of a free discharge, while its pressure on the valve seat, on return, is such as to prevent the escape of steam.

No other element, either flat disc or corrugated type, has such a long life as the Sarco element, due to the spiral (not annular), corrugations which distribute the valve movement over practically the entire drum.

When you install the Sarco you get year-in-year-out durability as well as efficiency.

Drop us a postcard for illustrated Booklet R-103.

SARCO CO., Inc.

236 Broadway, New York City

Boston Buffalo Chicago Cleveland Detroit Philadelphia
Peacock Bros., Limited, Montreal

What Do You Pay for Steam?

(*Continued from page 22*)

we want to know just where each heat unit goes and why.

Let us say that our Heat Balance is as follows:

	B.t.u.	%
Heat absorbed by the steam	7200	60.0
Heat in dry stack gases	2400	20.0
Heat of combustible in ash	720	6.0
Heat lost by radiation	960	8.0
Heat loss due to moisture in fuel	84	0.7
Heat loss due to burning hydrogen	600	5.0
Heat loss due to incomplete combustion	36	0.3
Total Heat in One Pound Coal	12000	100.00

Analyzing this record for a moment it requires no higher mathematics to see that the total heat in the coal is equal to the sum of the heat absorbed by the boiler plus the heat represented in the various losses.

The largest loss is the stack or dry flue gas loss, which comprises the sensible heat carried away by the gases leaving the boiler setting. The amount of this loss depends upon the quantity of gas passing from the boiler in a given time and its exit temperature.

Since this gas is the result of the combustion of the fuel, it is obvious that for every pound of coal burned the quantity of flue gas will vary according to the amount of air supplied for combustion purposes. An excess of air over what is actually required for complete combustion is harmful, because it absorbs heat from the hot furnace and carries much of this absorbed heat out of the setting with it. Expressed in another way, excess air cools the furnace temperature.

The amount of excess air in the flue gases can be determined by analyzing the per cent. of carbon dioxide (CO_2) which the gas contains. High percentages of CO_2 indicate the presence of very little excess air.

Suitable instruments are available for this purpose, the simplest of which is the hand Orsat. More satisfactory records are possible, however, with the use of a CO_2 recorder, which is really an automatic Orsat for making a continuous record upon a daily chart.

There may be several causes for the presence of excess air in the flue gases. First, the fuel bed may be full of holes, through which air is rushing without coming in contact with the live coal. Black spots in the fire bed indicate holes and should always be covered with green coal.

Too thin a fuel bed also permits the passage of excess air. For a given load, given draft conditions and given grade of coal there is a "best thickness" of fuel bed, corresponding to maximum combustion efficiency and minimum losses. This thickness is best determined by trial, using a hand Orsat for the determination of the CO_2 percentages for different thicknesses of fuel bed. The thickness which gives the highest Orsat readings is the correct thickness for the conditions.

Once the correct thickness of fuel bed has been determined, proper conditions in the bed may be maintained by the use of a differential draft gage, mounted upon the boiler front, within easy view of the firing floor. The gage is so connected as to indicate the pressure required to force the air through the fuel bed. If the bed is too thin, the draft gage reading is abnormally low. If too thick, the reading is high. If there are holes in the fire, the reading is again low.

By the intelligent use of these instruments and the correct interpretation of their readings excess air may be reduced to a minimum and one of the factors in the dry flue gas loss held well within control.

But the magnitude of the stack loss is also determined by the temperature of the gases leaving the boiler setting. This temperature may be measured accurately by suitable recording thermometers and pyrometers. These instruments are so installed that a continuous record is obtained of the temperature of the gases as they leave the boiler setting.

High flue gas temperatures may be caused by dirty boilers, either outside, inside, or both. Where the feed water is impure, frequent boiler cleaning may be necessary to prevent the formation of excessive scale deposits upon the internal surfaces of the drums and tubes. Such deposits act as an insulating jacket, preventing the efficient absorption of the heat in the furnace gases by the water in the boiler shell.

Soot and other deposits upon the external surfaces of the tubes has the same insulating effect. These deposits should be scoured from the tube surfaces at regular intervals with a steam hand lance. Where permanent soot blowers have been installed the blowing of tubes is not la-

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borious and it is possible to maintain clean tube surfaces without much difficulty.

Clean boiler surfaces are essential to the maintenance of high operating efficiency, minimum heat losses and minimum steam power costs.

High flue gas temperatures are also caused when the hot furnace gases take a short cut through the boiler setting instead of following their otherwise devious path. This short-circuiting occurs when the baffles have become cracked or broken. Thus the time of contact between the gases and the boiler heating surfaces is materially lessened, less heat is absorbed by the water and the gases leave the boiler setting hotter, carrying with them heat that would otherwise be available for the performance of useful work.

The existence of broken baffles of defective setting may be indicated by the use of a second differential draft gage, so hooked up as to read the amount of draft required to draw the gases through the setting. Broken baffles decrease the resistance to the flow of the gases, which condition is indicated to the fireman by an abnormally low draft reading. Abnormally high draft readings may be due to the presence of an excessive amount of soot deposits upon the boiler tubes.

In the normal operation of the average industrial boiler plant the dry flue gas loss is the largest of any of the heat losses. Nearly always it is excessive and sometimes it may be cut in half. Without adequate and accurate knowledge of what is happening within the furnace and boiler setting, however, this loss is not easy to cope with. Where suitable instruments are provided for furnishing the required information, it is usually the easiest loss to control.

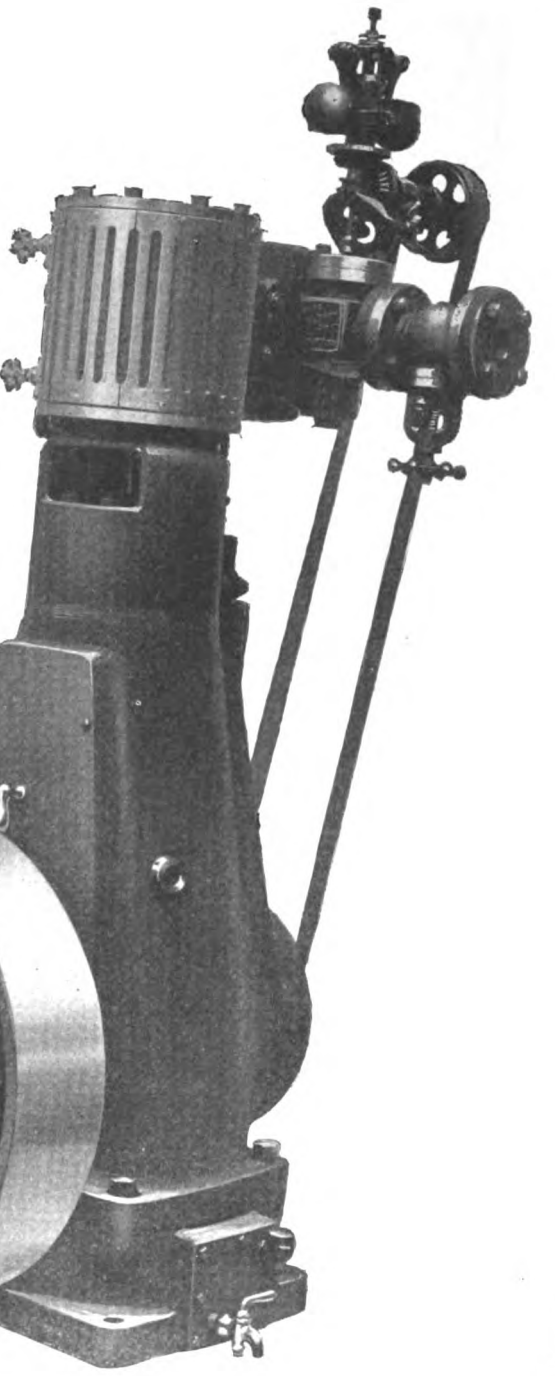
It is not practical, however, to eliminate this loss entirely. To do so would require the complete combustion of the fuel, with no excess air. It would also require that the flue gases leave the boiler setting at the temperature of the boiler room. Complete combustion with no excess air is possible only in a laboratory under special and ideal conditions. Very low flue gas temperatures are actually attained when economizers are used in conjunction with the boiler units. But it is not possible, even theoretically, to reduce the flue gas temperature lower than the temperature of the incoming feed water, say 212 deg. F. In the average plant a 10 to 15 per cent. flue gas loss is considered very good performance.

Next in importance among the boiler room losses is the amount of unburned coal lost in the ashes. In power plant operation it is neither practical nor possible to burn all the coal on the grate down to an incombustible ash. Slicing, shaking and dumping of the fires always carry some green coal into the ashpits.

Load requirements in boiler house operation do not permit long periods for careful cleaning of the fires. When considerable ash has accumulated upon the grates it must be got rid of as quickly as possible. The good coal is winged back and the grates dumped and covered again with all possible speed.

In stokered plants this loss is apt to be less because of the better control possible, through being able to burn down the coal that is on the dump plates before

A NEW TROY ENGINE



With the ever increasing tendency towards higher steam pressures and higher temperatures in power plant practice, we have added a new type Troy Engine to supplement our line of standard types.

The New Troy Engine retains all the features which have made the name Troy a symbol of economical engine operation, but is of **heavier design** to **fully utilize the higher temperatures** and **steam pressures** coming into use. The New Troy meets the demand for

Greater Power in Smaller Space

It is designed for the greatest durability and for the least delay and expense when worn bearings must be replaced. The number of parts which may wear and need replacement has been minimized.

The engine is designed with the Troy **steam tight admission valve** and is self-oiling—the circulating system supplies each bearing with a copious amount of lubricant. Yet, the working parts of this system are very simple and involve very slight wear.

With the New Troy added to our line of standard types we can now furnish an engine suitable to any condition and for any steam pressure.

Full particulars and Troy catalog on request.

TROY ENGINE & MACHINE CO.
TROY, PA.

The New Troy is now available in sizes from 5 to 40 H.P. Built for use with either throttling or automatic governor and for belt, chain or coupling drive.

Other standard types of TROY ENGINES made in sizes from 2 to 200 B.H.P.

TROY ENGINES

DEPENDABLE POWER with ABSOLUTE SAFETY

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Exterior and interior views of Westinghouse Elec. & Mfg. Co. plant, East Springfield, Mass. Equipped with 10 Skinner Bros. (Baetz Patent) Heaters.

If you are still using old-time heating apparatus that doesn't give you the service you should get, it is time now to investigate this new and more effective system. Its performance is amazing — it acts as a heater, ventilator and air conditioner combined and can be used summer and winter with equal advantage.

When You Think About Heat

WHEN you think about heat for next winter consider these essential facts about the Skinner Bros. (Baetz Patent) Heater:—

1st — This heater is built on a revolutionary principle—without the use of pipes or ducts as warm air carriers it actually heats all of the open area of a factory or plant.

2nd — A simple arrangement permits the unit to be used either as a heater or ventilator or as a combination heater and ventilator. It is useful both winter and summer and therefore affords real economy.

3rd — It is so effective that it needs to be operated only a few hours morning and afternoon to keep a building comfortably warm. Utilizes live or exhaust steam at any pressure. Simple to install and operate.

4th — It is sold on a definite guarantee basis.

The Skinner Bros. (Baetz Patent) Heater is so superior to old unsatisfactory types that it has been adopted by many industrial users in the U. S., such as Ford Motor Co., Quick Meal Stove & Range Co., Federal Foundry, Castanea Paper Co., St. Louis Independent Packing Co., and others.

SEND FOR CATALOG D-9 AND LIST OF USERS

SKINNER BROS. MANUFACTURING. CO., INC.
Main Office and Factory: 1474 South Vandeventer Avenue, St. Louis, Mo.
Eastern Office and Factory: 140 Bayway, Elizabeth, N. J.

Boston, 445 Little Bldg. Buffalo, 702 Morgan Bldg. Chicago, 1703 Fischer Bldg. Cleveland, 612 Marshall Bldg.
Cincinnati, 1060 Hulbert Street — Oliver Schlemmer Co.
Wash., D. C., 714 Evans Bldg. — U. D. Seltzer
Phila., Pa., 1711 Sansom St. — Haynes Selling Co.
New York, 1702 Flatiron Bldg.
Pittsburg, 8 Wood St. — Pittsburg Heating Co.
Spokane, 409 First Ave. — H. B. DeLong Co.
Detroit, 308 Scherer Bldg.

Skinner Bros.
Baetz Patent HEATING SYSTEM

letting the refuse down into the ash pits. A certain amount of live coal on the live grate area, however, usually avalanches and follows the ash into the pit.

Cleaning fires is a hard and hot job. There is not much time to be particularly nice about it. Nor is there usually the inclination. The main idea is to get the boiler back to work as soon as possible. The result is that considerable good coal "goes to glory" with the ashes. This loss is always greater with a high-ash coal than with a low-ash fuel, because where there are more ashes to be disposed of there is bound to be more good coal carried with them.

The important thing is to use every care in cleaning fires consistent with the load requirement of the plant.

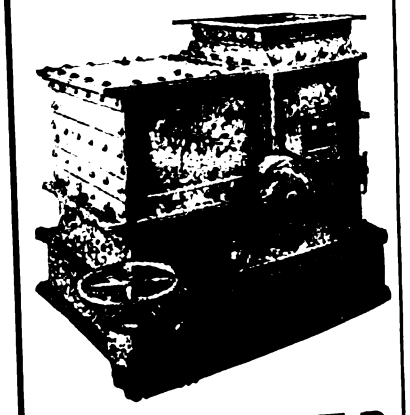
Heat is also lost by radiation from the boiler and setting. In older plants, where the insulation is in bad condition, this loss may exceed 10 per cent. of the heat in the coal. Where the boilers and setting are well insulated, however, the radiation loss may be as low as 5 or 6 per cent.

Other boiler operating losses are relatively unimportant, because they are more or less beyond the control of the men handling the boilers and because they are very small losses at best. This applies particularly to the moisture and hydrogen losses.

Incomplete combustion is the result of insufficient air for combustion. . Nearly every industrial boiler plant suffers from excess air. We may, therefore, safely pass up this possible loss as nothing to worry about. When the CO_2 recorder shows percentages, it is time to do one of two things, perhaps both. First, look for incomplete combustion due to insufficient air supply. Second, look for a possible error in the instrument reading.

Production of gasoline in the United States in October amounted to 659,060,570 gallons, constituting a new monthly record, states the Department of the Interior as a result of statistics compiled by the Bureau of Mines. Notwithstanding this record production, gasoline stocks on hand at refineries November 1 amounted to but 946,872,683 gallons, a decrease of 25,832,149 gallons, as compared with October 1.

PENNSYLVANIA

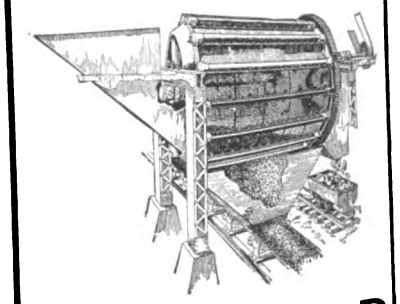


HAMMER CRUSHERS

39 Sizes

For Coal, Lime, Limestone, Shale, etc.

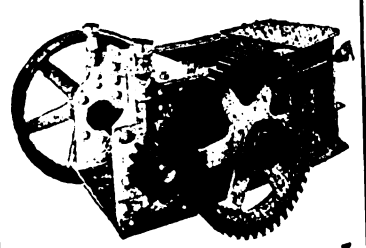
(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
(c) Oversize Bearings
(d) Patented Tramp Iron Separator
(e) Manganese Steel Wear Parts



BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

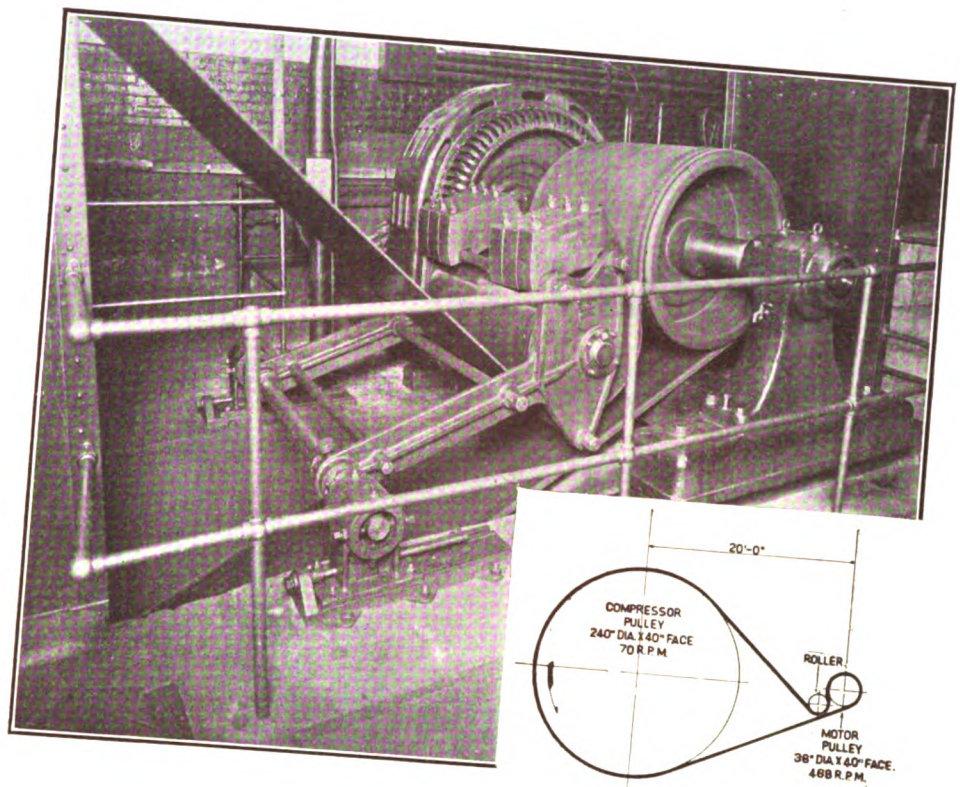
35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY
Stephen Girard Bldg., Philadelphia.
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THE LENIX DRIVE



Point Number Five---"High Pulley Ratios"

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

The increased arc of contact created by the Lenix makes it possible to use a pulley ratio considerably beyond the ratio limit imposed by good engineering practice upon an open drive.

In the installation illustrated the pulley ratio is 1½:10. If laid out as an open drive, good practice would have limited the ratio to 1:5. A lower speed motor would have been necessary, at a considerably increased initial cost. Then, there would be the difference between the efficiencies of the low speed and high speed motors. This difference is small, it is true, but when extended over years of operation it runs into money. This Lenix is saving that money for its owner.

Pulley ratios as high as 1:15 have been used with the Lenix Drive.

The Lenix is not an idler. It is a "belt wrapper," scientifically applied to belt drives for the purpose of increasing the arc of contact, eliminating belt slippage and improving the general efficiency of the drive.

Booklet: "SAVING SLIPPAGE AND SPACE" tells how it is done. Send for a copy.

F. L. SMIDTH & CO.
ENGINEERS
50 Church Street New York, N. Y.

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Where Tradition Is Still a Handicap

(*Continued from page 25*)

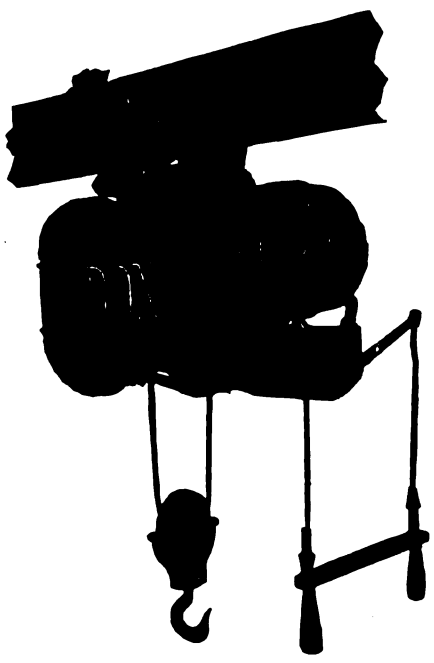
Even for those who have never handled six or seven wet brick, weighing from 30 to 35 pounds, it is easy to imagine the degree of physical effort a man must exert to do this work when the machine is running at capacity. Modern machines push a mold of nine brick out on a table, thump it and push the brick onto a pallet or tray, which is then easily slid off the table by a workman, and delivered to a conveyor at his side to be transported to the drying shed.

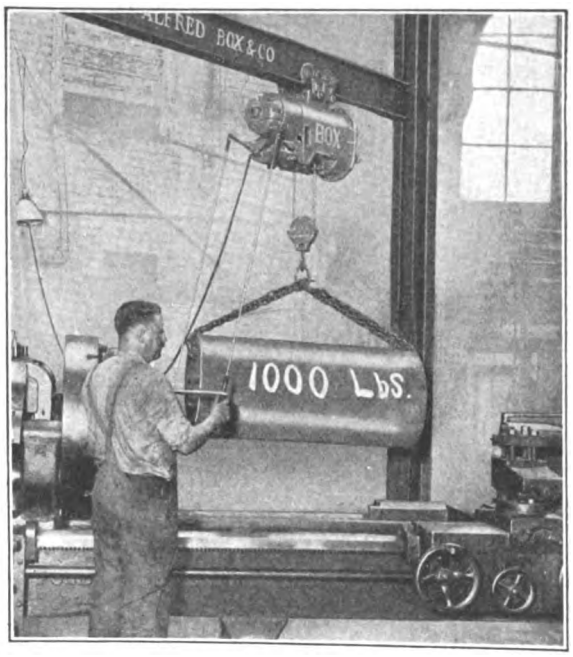
The next step in the process of manufacture is drying. Formerly this was done in the open air, relying entirely upon the sun and wind. The rows of brick, after being hacked up, as shown in one of the illustrations, were given a moderate degree of protection from rain by a roofing of boards laid along the top. A better plan than this has been in common use and consists in having sheds, open at the sides, in which rows of shelves were built on which the pallets of brick to be dried were placed. Even this system was largely dependent upon fair weather for successful drying, and of course afforded no protection when freezing weather set in. Drying houses, or dryers, offer the best solution to the problem and render brick manufacture independent of atmospheric conditions, making it possible to make brick throughout the year in those parts of the country where it had always been a strictly seasonal operation. With favorable weather, brick usually require from four to six days to become dry enough to put in a kiln. With a dryer, the same result can be attained in from ten to fourteen hours. The dryer is a long, one-story building containing shelves or racks on which the pallets of brick are placed. When heated by steam, the pipes constitute shelves for the pallets, steam circulates through them and the heat quickly dries out the water in the brick. In some dryers, flues are built into the floor and frequent openings are provided so that warm air or waste gases from the kilns can be forced through by a fan and thus effect drying. The dryer has ventilators in the roof to allow excess moisture to escape and between the rows of shelves there is a track on which small cars, carrying brick from the machine, are pushed in. In other cases, a conveyor takes the brick from the brick machine and passes completely through the drying house, where men unload the pallets as they arrive and place them on shelves.

In a steam-heated dryer, the brick are subjected during the drying process to a temperature of from 200 to 220 degrees F., depending upon whether exhaust or live steam is used. With a hot air system, practically the same temperature is maintained, as too rapid drying, due to a greater degree of heat than this, causes the clay to swell, crack and crumble.

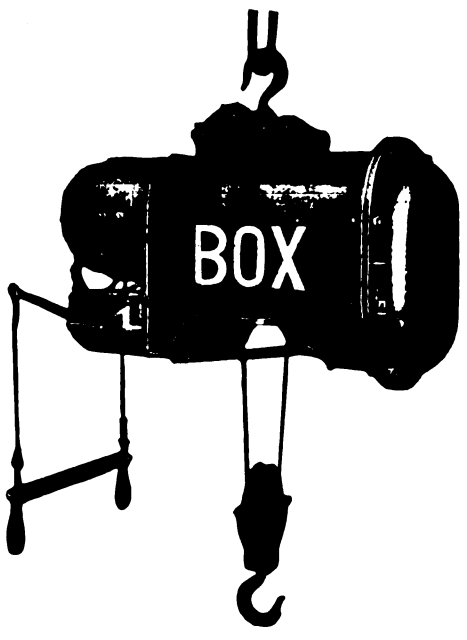
Burning, or firing, is the most difficult part of the process of brick making, for upon its

The One Man "LOAD LIFTER"





Alfred Box & Co., Inc., are also builders of the "Box Crane"—a standardized, heavy duty, Electric Travelling Crane, in capacities of twenty tons and under; also builders of hand operated Travelling and Jib Cranes of any capacity. In addition, full line of Electric Hoists to five tons capacity — embodied in which are all the important features found in the "Load Lifter."



Every phase of load lifting or shifting can be performed better, safer, faster and more economically by using the "Load Lifter."

The "Load Lifter"—with its great power, great endurance and sureness—has established records in lowering costs that are surprising.

* * *

The "Load Lifter" is built in one frame of two capacities—500 lbs. and 1000 lbs.

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management rests the tion of all the labor and of the preceding pro- The strength and use- of the brick depend if not entirely, upon the of heat to which they are ed, as well as upon the and uniformity with the heat is applied. The of heat on the clay causes al decompositions and inations that change its l characteristics. Clays neral are regarded by ts as consisting mainly of osilicic acid, sand and fusible minerals, carbon- calcium and magnesium, of iron, and a small quan- f organic matter. They n also a certain amount ter, chemically combined, hen subjected to the heat kiln, this water is driven the form of vapor, or e smoke," as the burners

decomposition of the fusi- inerals goes on as the heat ases, and when tempera- higher than 900 deg. F. attained, the fusible con- nts of the clay are oxid- the sand is fused, and the mass becomes substan- a silicate of alumina, lime iron. The color of the fin- l brick depends upon the re of the clay used, as well pon whether there is a de- ncy or an excess of air in kiln. Skill and experience essential in the successful ation of a brick kiln and a y responsibility rests upon boss who supervises the fir- He must know how hot to the kiln, how rapidly to in- se the heat, and how long naintain it.

ilns are usually of one or the er of two distinct types: up ft and down draft. The for is built by piling up the k with spaces between for t circulation, and building m at the bottom into long, tunnels or "arches" in which fires are kindled. The pile carried up to a height of 18 20 feet and contains 30,000 40,000 brick. The outside is ilt up of under-burned or soft ick and plastered over with d in order to close all cracks ring firing. The ends of the ches have cast iron doors rough which the fuel is intro- ced and through openings in hich the draft on the fire can regulated.

The down draft type of kiln built of cylindrical shape, or sometimes rectangular, roofed over with brick and lined with brick checker work. In some districts, these kilns are used exclusively, as they are reputed to give a more uniform degree of heat and a larger proportion of marketable product.

For fuel, wood was formerly universally employed, but its rapidly increasing scarcity has forced brick makers to adopt coal, both anthracite and bituminous, and to a limited extent, oil. From five to six days are required to burn a kiln of brick. When sufficiently cool to be handled, they are taken down and loaded for shipment.

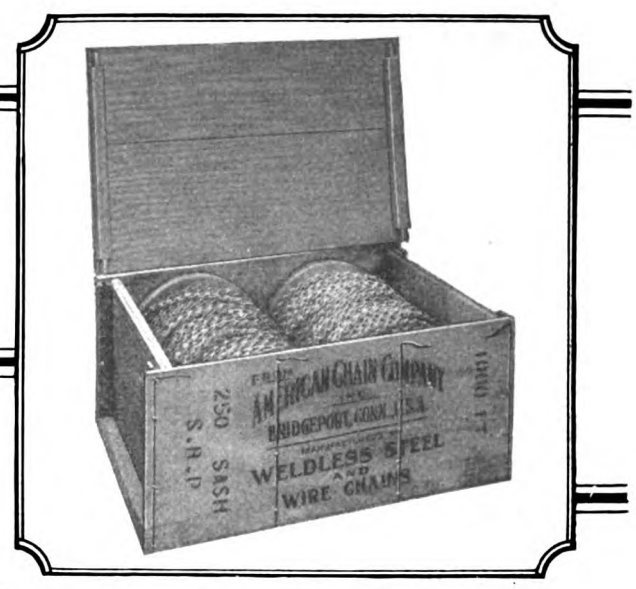
Even with the exercise of the utmost care in putting up and firing a kiln of brick, there is always a certain percentage of loss due to uneven distribution of the heat; the result of this being that some brick, especially those in the arches nearest the fire, are over-burned, while others are under-burned, spongy and pale in color. Arch brick are excessively hard and very brittle; and while excellent for use in fire-resistent construc-

Heavy Chains Shipped Safely in Pioneer Boxes



Above is shown how automobile tire chains are shipped. The chains are put in sacks and then packed in Pioneers.

The illustration below shows how heavy chains, wound on spools, are shipped in Pioneer Wirebound Boxes



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tion, lack the compressive strength needed to sustain the load in a tall building. The soft, under-burned brick are in disfavor for buildings, as they are greatly affected by dampness and go to pieces quickly if exposed to fire.

The temperature in a brick kiln ranges between 1650 and 2280 deg. F., and much depends upon its ascertainment and regulation. While millions of good brick have been turned out of kilns in which the degree of heat was determined solely by the skilled judgment of the boss burner, modern requirements call for the exact indication of temperature and a continuous record of it, without depending on one man's skill.

A fair degree of accuracy in the determination of temperature can be obtained by the use of Seger cones, made of prepared clay so combined with other materials that they will soften and disintegrate at a certain temperature. Several such cones, each of such composition that they soften at a definite degree of heat, are put in the kiln, one to melt at say 1600, another 1900, another 2150 degrees, and so on. The burner watches through a peep hole in the side of the kiln, and as each cone softens and crumbles away, he knows that the corresponding temperature has been reached.

Greater accuracy than can be attained by this method, however, is often required, and in the most progressive brick plants, thermoelectric pyrometers are extensively used. These instruments not only give exact indications of temperature, but can be arranged to record the temperature automatically and continuously during the entire period of firing.

This information has a distinct money value to the manager of a brick plant, because experience has demonstrated that where the heat of a kiln is known with exactness, there is a larger percentage of good, marketable brick in the output. With a pyrometer properly connected, a boss burner can see at once how hot his brick are getting and can also determine this for any one of a number of kilns that may be burning simultaneously. A recording pyrometer gives a graphic record of how well the burners have maintained their fires during the night or during any period. By thus enabling the heat to be more closely regulated, a shorter burning period can be secured and in consequence, a considerable saving of fuel. Some makers have reported that they were able to burn brick satisfactorily in three days when using pyrometers, compared with a five-day burn when they were unable to determine temperatures with exactness.

The pyrometers in general use are made of platinum with a platinum-iridium alloy; or of a nickel-copper alloy with copper, iron or nickel-chromium. The thermocouple made of such metals is enclosed in a porcelain tube which in turn is placed inside a heavy, fire clay tube sealed into the roof of the kiln, and conducting wires are run to an indicating galvanometer, whose scale is calibrated to read in deg. F.

Throughout the process of brick manufacture, machinery has gradually superseded hand labor for many operations; and while it is impossible entirely to substitute machines for men, yet in the best equipped plants the number of employees per thousand brick produced is much

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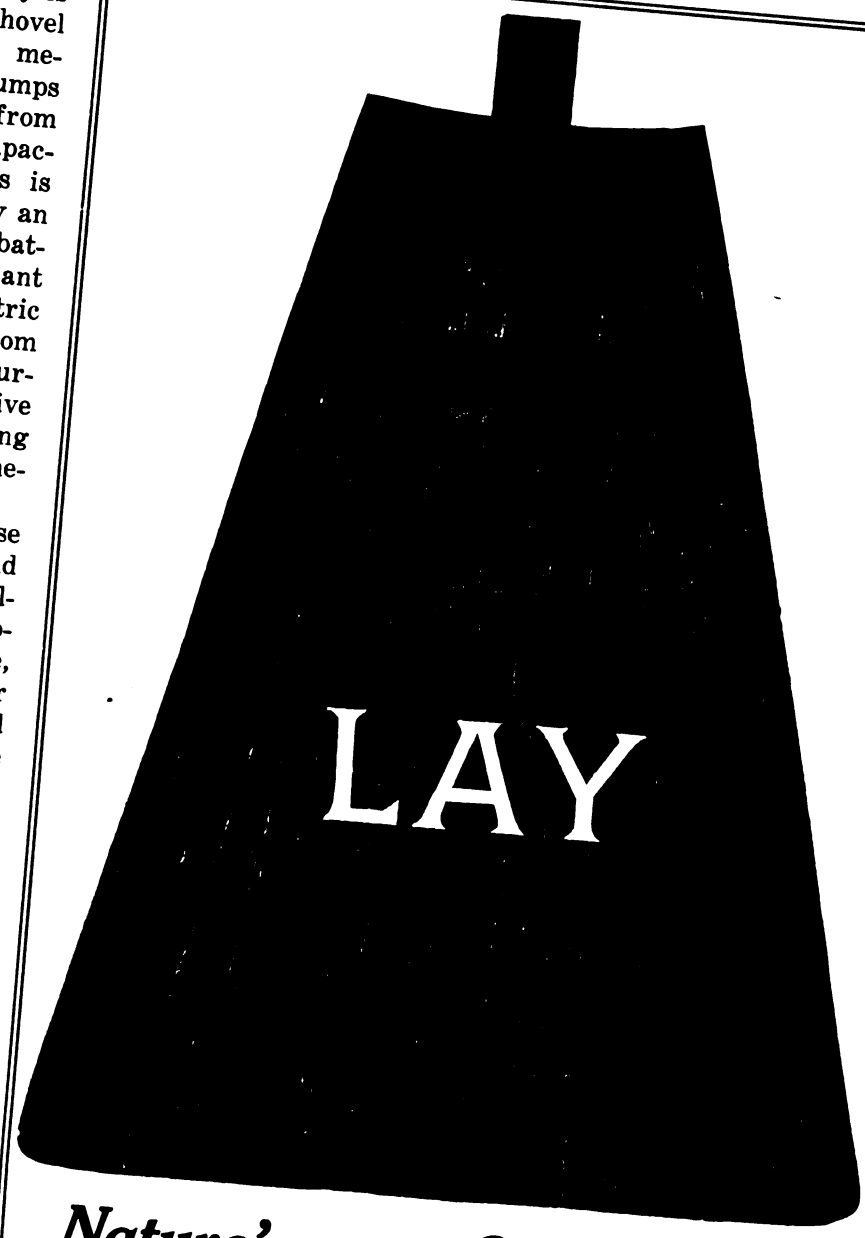
smaller than formerly. The mining or digging of the clay is done by means of a steam shovel or some other form of mechanical excavator, which dumps its load into small cars of from one to three cubic yards capacity. A train of such cars is hauled to the mixing pits by an electric trolley or storage battery locomotive. At one plant visited by the writer, an electric locomotive, taking current from two trolley wires, and a four-cylinder, gasoline locomotive were doing equal work hauling clay cars for a distance of one-half mile to the mixing pits.

Many kinds of mill are in use for crushing, pulverizing, and mixing the clay, sand and coal-dust in the course of their preparation for the brick machine, but such mixers receive their clay directly from the cars, and in suitable proportions also the other ingredients are dumped; often motor trucks with dumping bodies being employed. Where there is a sand bank on the property, and in many cases there is, the sand is dug out, elevated to a screen, poured into a bin and delivered to a truck without any manual labor whatever.

Manual labor was formerly employed to load the molded brick on wheel barrows and dump them out on the floor of the yard to dry. Later on they were "hacked" up in rows about four feet high, the brick being set up with spaces between adjacent brick to allow for circulation of air.

The usual proportion, with the machinery and methods of twenty-five years ago, was one man per 1,000 brick per day. Thus a yard producing 40,000 brick daily employed about 40 men. The ratio is better now, although the men will not handle as many brick as formerly, and their pay is more than double what it was at the time referred to. Better methods and improved machinery have, in spite of this, increased the output per man.

The ingredients having been thoroughly mixed are next transferred on a belt conveyor to a hopper in which they are soaked with water and from which they drop into a pug mill. This is a trough or box, usually constituting an integral part of the brick machine, and having a shaft running through it on which is a series of vanes or knives that mix and push the mass of clay from the hopper



Nature's own Contribution to Plant Maintenance

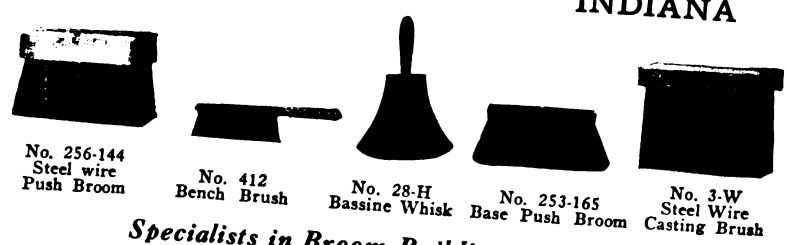
Every Fibre in a LAY Broom is built in intact,—just as it grew on the stalk,—brush and all. *You can't improve on Nature.*

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end to the other, where it is forced into the brick machine, which molds it to shape. Formerly it was necessary to do a great deal of hand shoveling in the process of mixing and delivering to the pug mill. In one type of machine, the pug mill is combined with what is called an auger machine, the curved blades of which force the wet material through a die, which delivers a column of clay on the table of a cutting machine equipped with a number of taut, parallel wires that cut the clay into bricks. From the table of this machine the bricks are transferred to the dryer.

The advantage of improved machinery and methods is this: that manual labor, even though men work more slowly than formerly, is rendered more efficient through the employment of machinery. For example: at one brick yard the managers report that since the introduction of modern equipment, six men do more work, in terms of brick output, than thirty men formerly accomplished by the crude machinery then in use.

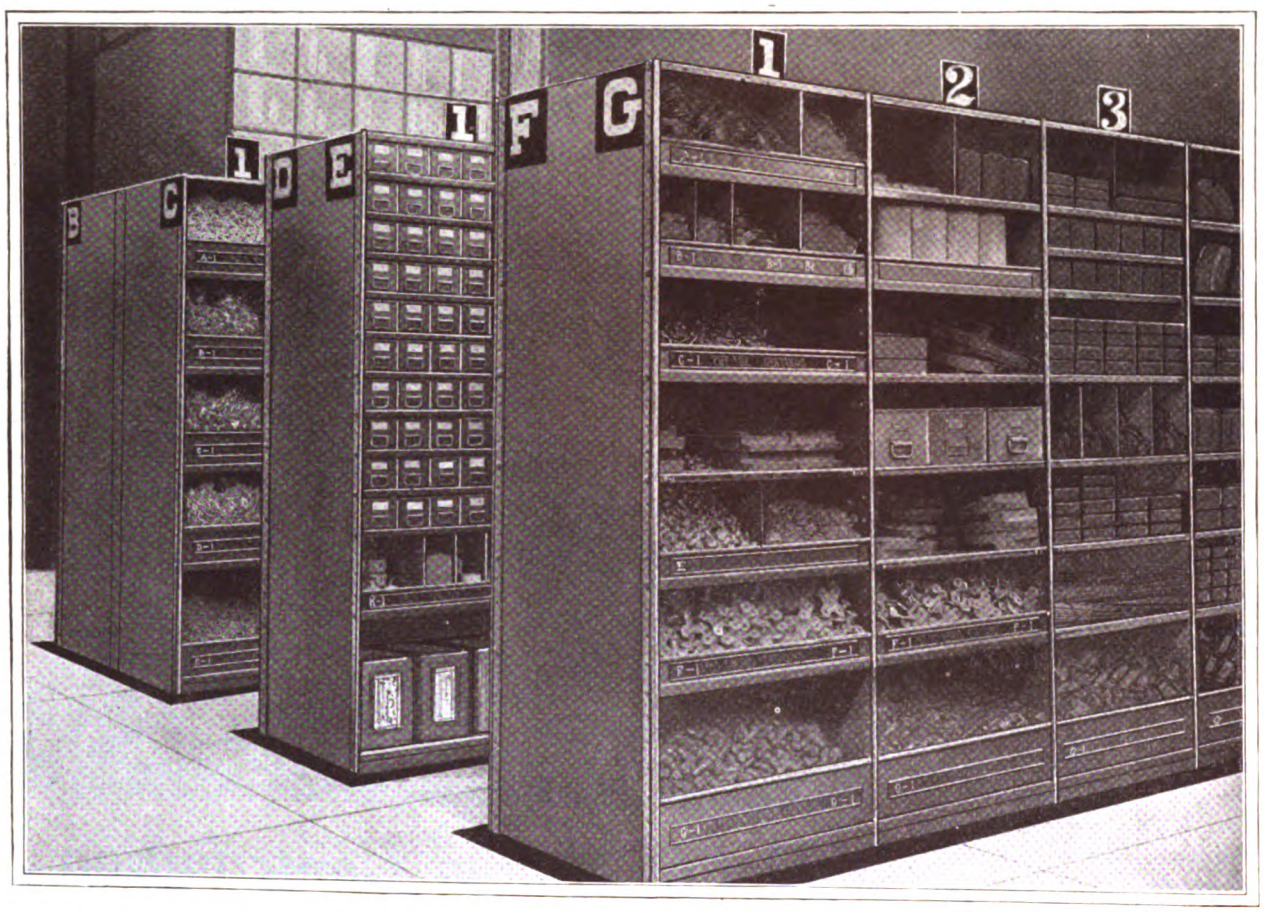
The installation of a conveyor and the addition of improved mixers and feeders for the clay, and machine handling at the kilns eliminated the employment of eleven men.

At another plant, the installation of a conveyor to take brick from the machines to the dryer did away with five truckers.

One brick company rearranged its plant and installed modern machinery at an outlay of several hundred thousand dollars. Fewer men are now required, a saving in wages of $72,000 a year has been effected, and *more brick* are turned out.

An important step in the standardization of building materials with a view to reduction of costs has been taken through an investigation by the United States Department of Commerce on the various sizes of brick produced by different manufacturers. The inquiry showed that 167 brick making plants throughout the United States were manufacturing 39 different sizes of rough brick during 1922; and that 141 plants made smooth brick in 36 varieties. For the purpose of simplifying this condition and of reducing the number of superfluous sizes, a committee recommended that only two sizes be made; thus eliminating 38 rough and 35 smooth brick varieties. It was estimated that more than 80 per cent. of the brick made in the United States is of the average dimensions covered by the recommendation. The committee, in addition to representatives of the Division of Simplified Practice of the Department of Commerce, included members of the United States Chamber of Commerce, the American Face Brick Association, the American Institute of Architects and the Supervising Architect's Office of the Treasury Department.

Too little account is taken of the ultimate effects which the proposed railroad rate cuts would have upon the railroad owners, upon other shippers and consumers, and upon the farmers themselves. The question of proper freight rates for farm products involves the whole rate structure. If these rates are to be lowered, producers of other basic commodities will find occasion to demand similar revisions.—*The Guaranty Survey.*



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In this up-to-date stockroom two men fill several hundred orders per day from seven Lyon Standard Steel Racks. These racks are all 8 feet high, 12 feet long and 3 feet deep.

In two racks dividing backs separate the shelves, giving 18 inch shelves on both sides. Bin fronts are used where the stock keeper stores quantities of small loose parts. The boxes used in one rack are subdivided so that five different items are kept completely separated in each box.

These racks carry heavy loads and a great variety of parts. This is a fair example of how a complicated stockroom problem can be simplified and confined to a comparatively small space.

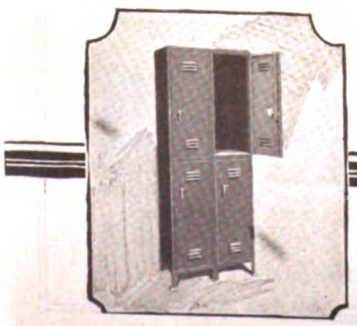
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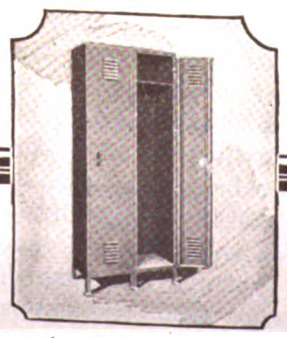
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Making Seattle A World Port

(*Continued from page 26*)

in 1916, the feasibility of the proposition had been recognized and considered both by Seattle's citizens and by the War and the Navy Departments. Those pioneers who were able to visualize the great lumber mills and other industries which now operate day and night along the shores of Lake Union, had for years fought valiantly to achieve the success of their plans. Barring emergencies, however, improvements of a far reaching character are usually secured only after the overcoming of considerable opposition, much of which is usually offered in good faith. And this case was no exception.

Groups of land owners and private interests of various kinds endeavored to block the progress of the scheme. They opposed it because in equalizing the level of the two lakes by means of the connecting canal, Lake Washington would be lowered about eight feet, and dire results were predicted. They derided the idea of opening Lake Union to industry—it was unnecessary, they thought, in view of Seattle's admirable salt water tidal harbor on Puget Sound. Their objections are cited only as a sidelight upon the facts as to the commerce which has actually developed in the seven years since the waterway was opened.

The locks themselves are massively constructed of reinforced concrete. The longer of the two is 825 feet in total length, 80 feet wide inside and 56 feet high. At the base its walls are more than 50 feet thick. Three sets of electrically operated steel gates serve to divide this lock into two compartments, 475 feet and 350 feet long respectively.

The smaller lock adjoining is intended to accommodate light craft only. Its total length is 160 feet. The dam is of the fixed type, with a movable crest composed of a series of segmental steel gates which permit the level of the lakes to be held at an even elevation, viz., twenty one feet above low tide. The lift of the locks is twenty six feet, and the depth of water over the sills is such that with the exception of dreadnaughts, practically all of the Navy's vessels could, if necessary, be passed through into an impregnable harbor. The total distance to Lake Washington's deep water from Puget Sound is about eight and a half miles, a part of which lies through the deep water of Lake Union.

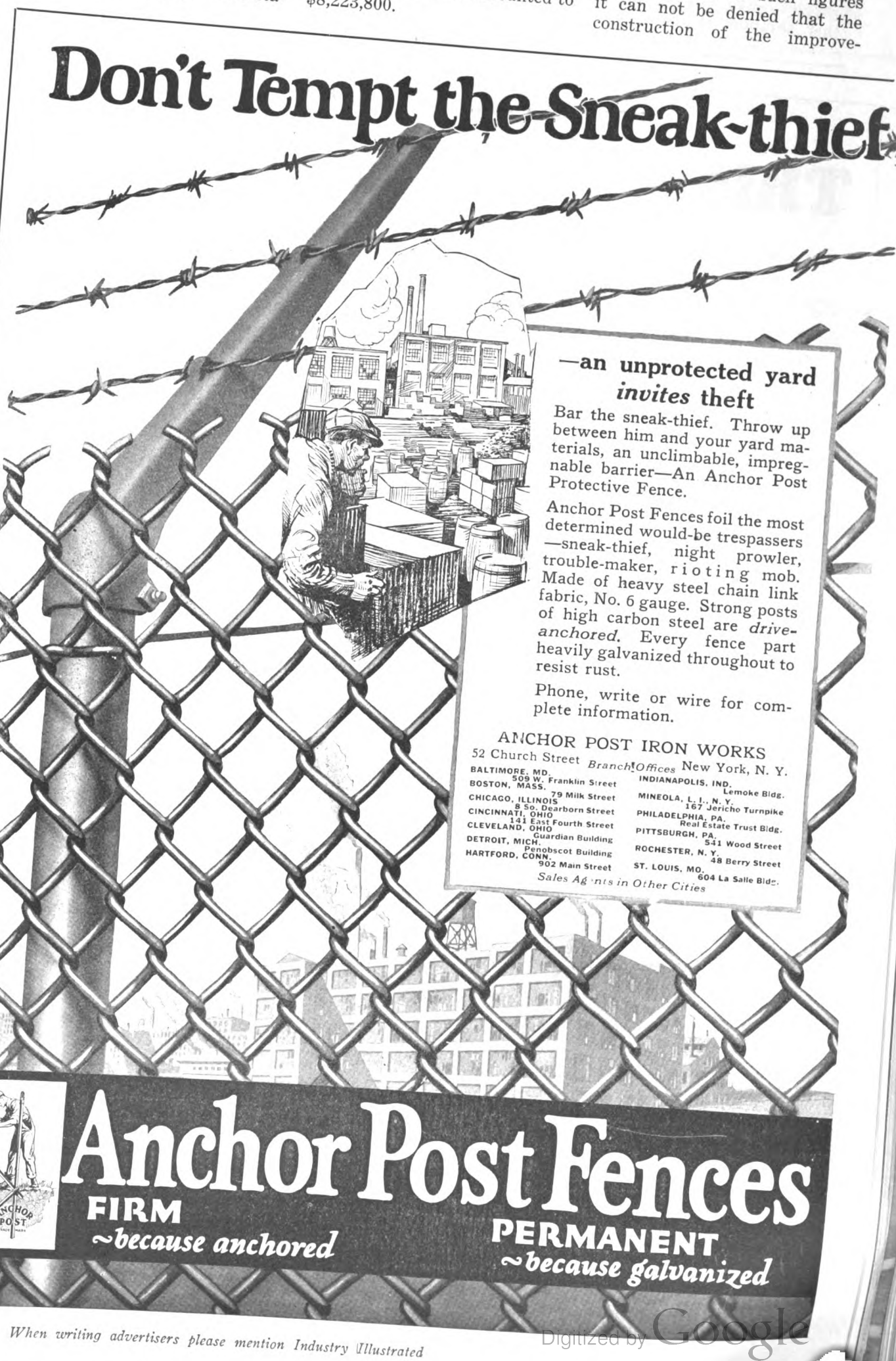
Facts shown below, relative to the volume and the value of the cargoes which have passed through the locks during the few years that they have been operated are illuminating. The statistics, prepared by the War Department, show that the principal commodities are logs, lumber, fuel oil, sand, gravel, paper, coal and fish.

The values as shown include that of the floated timber. In 1920 this item alone amounted to $8,223,800.

TRAFFIC THROUGH THE LOCKS
In Tons of 2,000 lbs.

Year	Tons	Value	Floated Timber
			Tons
1917	650,300	$ 4,254,200	543,000
1918	765,400	6,521,100	554,000
1919	1,020,700	9,520,400	774,000
1920	1,368,900	15,567,800	918,700
1921	1,503,766	14,777,343	826,887

In the face of such figures it can not be denied that the construction of the improve-



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ment has opened up great possibilities. Yet even with such a splendid showing, it may be said that they have scarcely been touched. For as yet the industrial development has been confined almost entirely to Lake Union. Lake Washington's wooded shores have not yet been provided with the docks and other shipping facilities necessary for commerce. They are therefore almost untouched by the hands of trade, and are dotted with residences commanding attractive views of the locality.

A distinct advantage to industrial plants located along these fresh water lakes lies in the freedom from attacks of the teredo upon pile foundations. This troublesome little pest, found only in salt water, creates havoc with such structures of timber as are exposed to its ravages. Marine growths, such as barnacles, which attach themselves to hulls plying in salt water, drop off after a short period of anchorage in Seattle's lakes. Although they carry much of the paint with them, the expense of scraping the bottoms is almost eliminated. Another feature—that of the constantly stable lake level, is of advantage principally to smaller craft, not provided with derricks for hoisting cargoes; equipment which is of course essential in a tidal harbor.

It is instructive and interesting to watch the huge lock gates at the Lake Union entrance to the canal slowly and noiselessly close at the touch of the attendant's hand upon the electric controller. Perhaps a tug boat, towing a raft of logs, is passing through. Or it may be a great freighter, laden with a cargo for a distant Oriental port. Again, the vessel may be a luxurious pleasure yacht, headed for some beautiful island camp in the Puget Sound region. They all pass either way without charge, for Uncle Sam operates his locks with a generous spirit, although at a cost to him of more than $71,000 a year.

When the craft has been safely enclosed within the chamber, unseen valves open, and the water rushes out through channels beneath the structure, boiling up in a mad whirl below the locks, as it mingles with the brine of Puget Sound. Swiftly the vessel is lowered to the tidal level. In a few minutes the outlet gates are opened, and the tug, the ocean tramp, the schooner or whatever it may be, proceeds upon its way.

Prediction as to the extent to which commercial development will advance during the next decade as a result of the opportunities presented by these works, is a difficult matter. Certainly Seattle has not been slow to realize their benefits, and having an ambitious spirit which would develop this city into the "New York of the Pacific," there is no doubt that progress of a substantial character will be achieved.

"The extent to which Germany has so far succeeded in keeping her industrial machine intact is due in no small part to the elaborate scale on which her standardization work is performed," it is stated in the bulletin, which was prepared by Dr. P. G. Agnew, secretary of the American Engineering Standards Committee, who recently returned from Europe, where for two months he made a study of the standardization movement and the manner in which European developments in this direction are likely to affect American industry.

WORTHINGTON

This Compressor Saves $775 a Year

The air compressor shown is a Unaflow steam cylinder machine having a capacity of 1,500 cubic feet of air per minute. This compressor under usual conditions will save 4,980 pounds of coal in an eight-hour day, as compared with a Meyer Gear Compressor—a saving which amounts to $775.00 in a year.

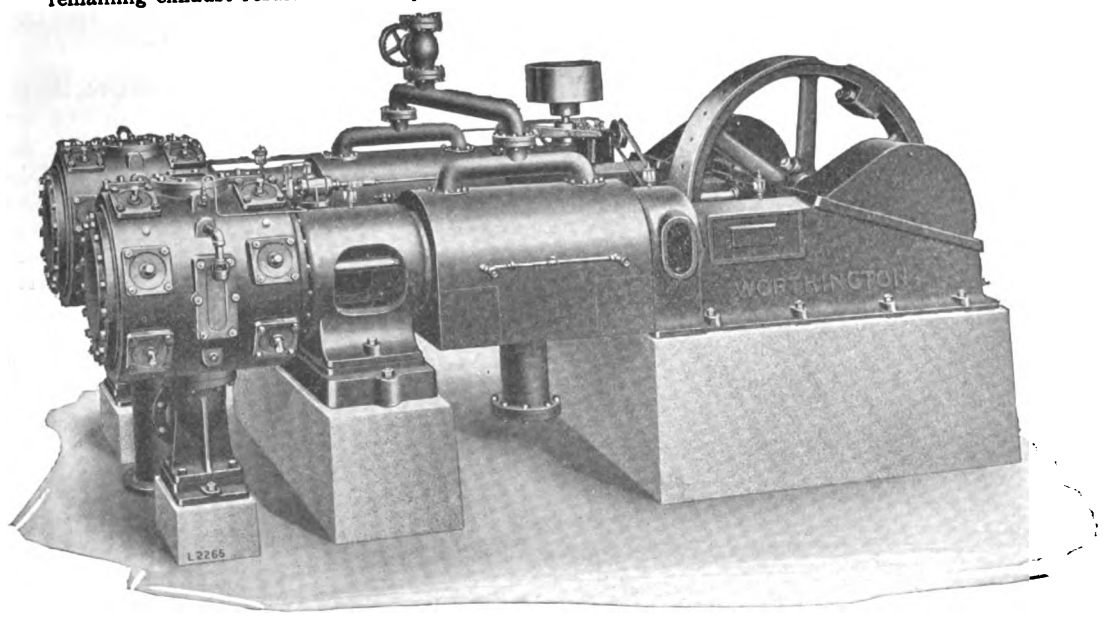
With the possibility of your saving operating costs at that rate you will enjoy reading Bulletin L 542-A.

THE UNAFLOW ENGINE

Another contributing reason for the exceptionally high economy of the Unaflow compressor is high compression. As the steam, expanding away from the cylinder head, rushes out through the central exhaust port, it carries practically all the wet steam out through the exhaust. When the exhaust port is closed, by the returning piston, the remaining steam, which is comparatively free from moisture, due to the effect of the steam jackets, is compressed to practically initial pressure.

This adiabatic compression of the remaining exhaust results in a compression temperature actually above the initial steam temperature. The live steam, upon entering the cylinder, thus comes into contact with steam filling the clearance at practically its own pressure, and at a temperature higher than its own. Furthermore, the surrounding metal surfaces are likewise at initial steam temperature.

As a result, cylinder condensation is practically eliminated, and a performance is obtained that is most exceptional. Worthington Unaflow Compressors lead the market by their remarkable economy and smooth operating qualities.



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Snow-Holly Works *Buffalo, N. Y.*
Epping-Carpenter, *Pittsburgh, Pa.*

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Research and the Modern Industrial Laboratory

(*Continued from page* 15)

causes for discouragement. I know of large industrial laboratories started since the war which have been discontinued. I know of sections of the National Research Council where the only accomplishment has been to hold a committee meeting and print the minutes. Much of the research work undertaken at universities has been characterized by the Carnegie Foundation as "pseudoresearch." I have seen one annual report of the research section of one large engineering college which described some twenty problems on which the students were engaged, and not one of those problems was what I would consider true research, nor of value in teaching research methods.

These things may result in discrediting research and in starting a backward swing to pre-war conditions. Should that swing occur, it would be a long and difficult task, without the war stimulus, to get back again to where we now are.

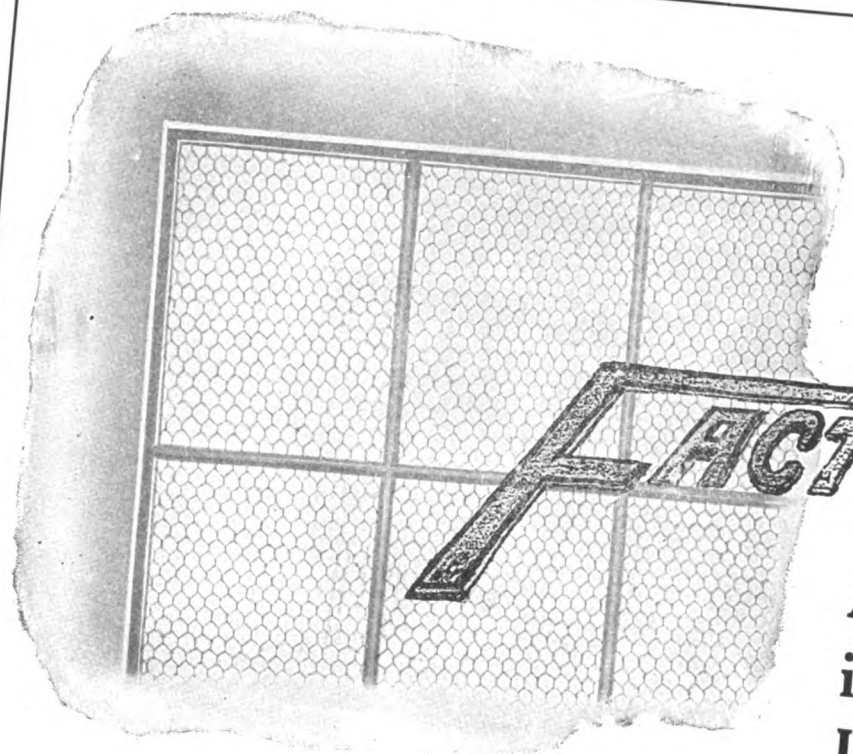
The extent of that loss could be testified to by anyone in the General Electric Company who knows what research has done for that company. Whole factories and larger sections of other factories are engaged exclusively in producing devices or materials that originated in the Research Laboratory. Every department of the company has profited in the way of improved devices or reduced cost by the work of the laboratory.

Established twenty-two years ago, the General Electric Research Laboratory, begun in a small way, has expanded until it is now one of the most complete and most noted institutions of the kind. The Research Laboratory occupies the major portion of five floors of Building No. 5, which is located at the entrance to the Schenectady plant. The floor space utilized, 89,336 square feet, is divided into 132 rooms.

The basement of the building is used to provide facilities which are in general demand, such as electrical power, vacuum, liquid air, motors, transformers, and rheostats. Power is distributed at 125-250 volts, D. C., and 550-240-120 volts, A. C., from 154 trunk lines, and also by separate lines from twenty-four motor generators. The distributing pipe lines also have service valves in this basement.

The pipes and wires are arranged in horizontal ducts large enough for workmen to make alterations and repairs. These ducts are directly over the corridors. Ample head-room provided throughout the building makes this duct construction possible. Vertical ducts connect these horizontal ducts to the basement. This system requires about five miles of pipe, and forty miles of insulated copper cable. The wiring arrangement will allow each cable to be withdrawn and replaced without undue interference with the others.

The vacuum pipe line has been given special care. Four-inch standard pipe was used, on which threads were carefully



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Knowing the importance of greater conservation of daylight, research work of this company has for many years been directed toward the production of a glass with high diffusing power.

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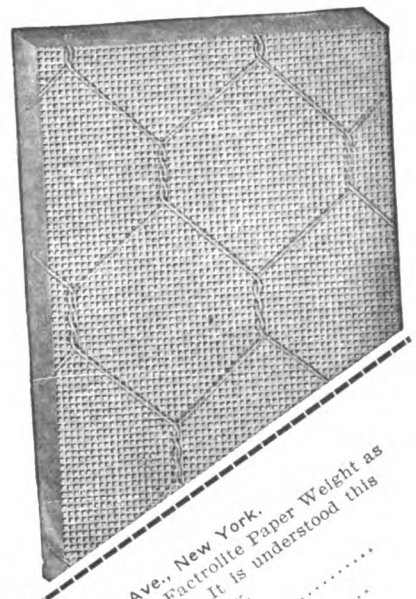
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Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way.

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cut. Special fittings which provide for lead calking assure minimum leakage.

Each work room has available city water, river water, illuminating gas, compressed air, vacuum, high pressure hydrogen, low pressure hydrogen, oxygen, live steam, low pressure steam, vacuum cleaning, and distilled water. One or two terminal switchboards are also provided, from which a maximum of 250 kw. can be drawn, or connections made to any other room, or to basement distribution board, and from there to other laboratories in the plant. Experiments requiring 20,000 amperes, 200,000 volts, temperatures of 3,000° C. or —200° C., and highly reducing or oxidizing atmospheres, are possible from standard equipment.

On the first floor of the laboratory are offices, the library of 3,000 volumes, and six experimental rooms used for X-ray investigations. The X-ray equipment comprises a Victor high voltage machine capable of giving 30 milliamperes at 280,000 volts, a Symmetric machine of approximately the same voltage, but lower current capacity; a Snook interrupterless machine of 100,000 volts, 100 milliamperes; two Waite & Bartlett machines of the same rating; a constant potential continuous current outfit for 200,000 volts, 10 milliamperes; an oil-immersed dental outfit for 40,000 volts, 10 milliamperes; a Ritter dentist's unit; a Victor radiographic table; a complete tube exhaust system; a photographic dark room, and miscellaneous equipment, such as 25 cm. sphere gap, 12½ cm. sphere gap, ionization chamber, spectrometer, etc.

Connected to the rear of the building there is a one-story section of 4,000 square feet, with 23 foot head room, which is at present used as a metal working department. Rolling mills ranging from 10 in. by 12 in. to 2 in. by 4 in. are perhaps the most impressive pieces in this section, but there are also 100-ton hydraulic presses; tungsten and molybdenum treating equipment, several swaging machines, wire drawing apparatus, dozens of high temperature hydrogen furnaces; ball mill, sifting apparatus, and vacuum furnaces.

Several years ago this section was used as a small experiment porcelain plant. It has also been used for steam turbine and boiler corrosion test. Two small cranes are used to handle the heavier pieces.

A tile roof on this section provides space for outdoor experiments.

A large portion of the second floor is devoted to model and apparatus construction, and contains a machine shop, carpenter shop, and transformer and coil department.

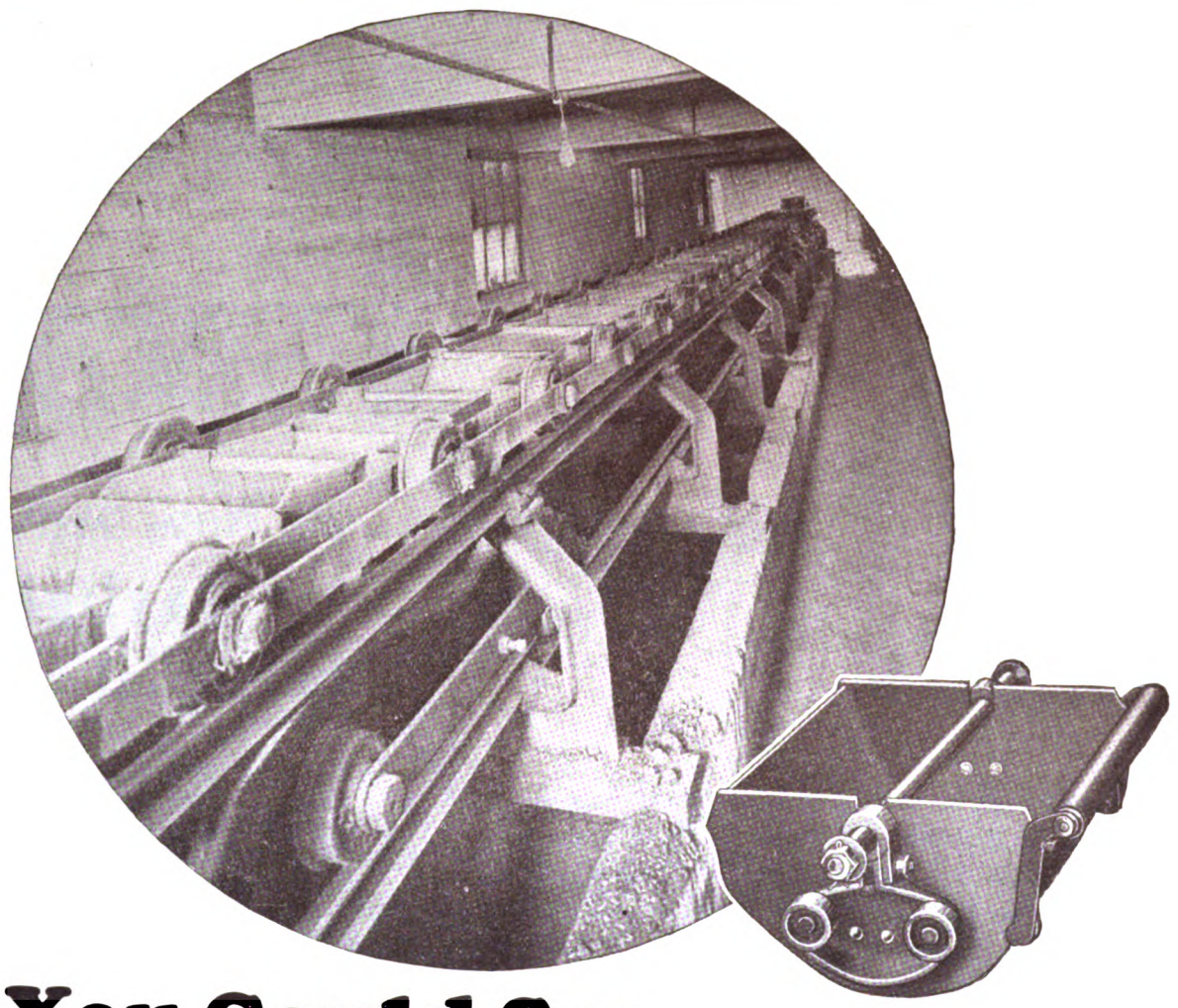
The machine shop is equipped with a wide variety of tools, including lathes, millers, shapers, drill presses, disc grinders, surface grinders, external and internal grinders, precision lathes, and diamond die drilling and polishing machines. It is seldom necessary to call on the larger shops for facilities.

The carpenter shop is equipped as far as possible with machines, but its chief function is to provide a high grade of hand work on wood, or similar material.

The transformer department furnishes special electrical apparatus which is not readily available from the factory. It also utilizes untried methods of winding and insulation, thus aiding the search for the best.

The analytical laboratory is

(Continued on page 72)



If You Could See

THE Perkins Pivoted Bucket Carrier At Work—discharging a continuous stream of coal on the upper run and ashes on the lower run of conveyor—at a tremendous saving of man power—

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The Perkins Pivoted Bucket Carrier handles both coal and ashes with low operating and maintenance charges. It does the work mechanically releasing labor help for more profitable work.

Sturdily built and mechanically correct in design it insures years of reliable and dependable service. This is demonstrated by the number of Webster installations successfully operating in power plants today.

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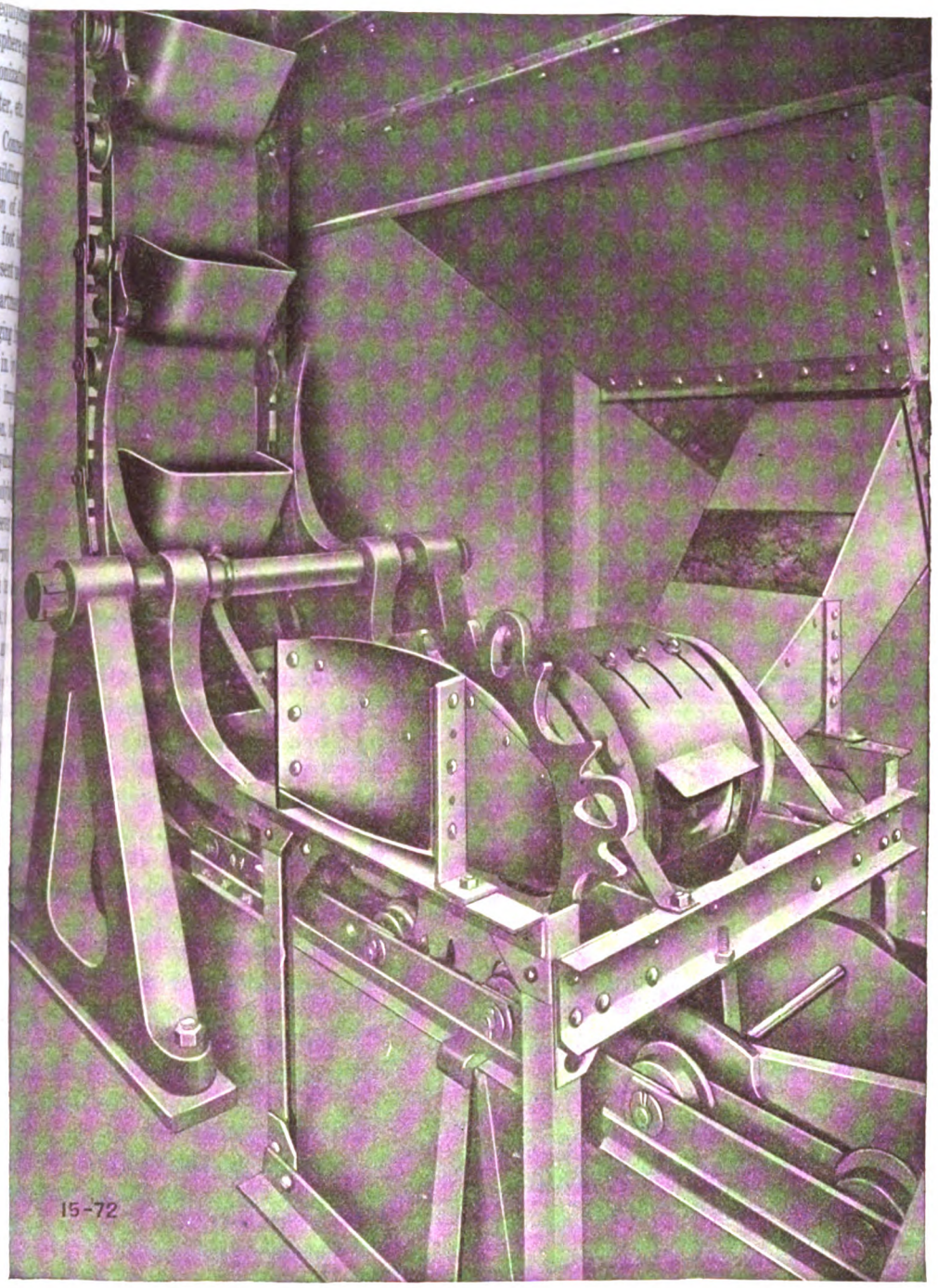
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Hunt Pivoted Bucket Conveyor, showing Filler and fixed curve for cramped quarters.

The buckets are loaded by a filler of the revolving drum type, which is driven from the conveyor chain through a wheel designed to properly engage in the links of the chain. The filler moves in perfect synchronism with the conveyor and gives an equal charge to each bucket, filling each bucket to capacity without spilling the material over the edges or between the buckets. It furthermore prevents dust and grit from getting into the working parts of the conveyor.

All industrial executives realize that unless their business is so conducted that a profit accrues, their activities are doomed to failure. No project whatsoever is exempt.

Yet what is done to insure that profit? The answer may be,—and generally is—"We effect economies wherever and whenever possible!" But this usually applies broadly to the business as a whole; specific cases are often overlooked; such as, for instance, coal and ashes handling and rehandling.

Inadequate methods for performing this function is an expensive burden. These may consist of obsolete or unsuitable mechanical devices that are forever getting out of order, requiring constant attention and repairs, causing expensive shut-downs and loss of production; or perhaps the old back-breaking, muscle-straining, wheelbarrow system is in vogue. All, or any, of which add to the handicap imposed by the high cost of fuel and labor, before a pound of coal enters the furnace. Then, too, there is to be reckoned with, the removal of ashes.

Here, in the initial function of power generation, the executive can effect economies that will be reflected in the profit on his product, if he will but choose wisely in the selection of his coal and ash handling apparatus.

Hunt Coal, Ashes and Coke Handling Machinery has won the approbation of executives in every industry during the past half century because of its ruggedness, freedom from serious breakdowns, low upkeep and its ability to perform long and satisfactory service under the most severe conditions with the greatest economy.

Hunt Engineers, with an experience in Coal and Ash handling problems of every character extending over half a century, supplemented by a vast amount of data accumulated in that period, will gladly help plan a handling system suitable for your present needs with ample allowance for future expansion. Don't hesitate to call on them for any assistance.

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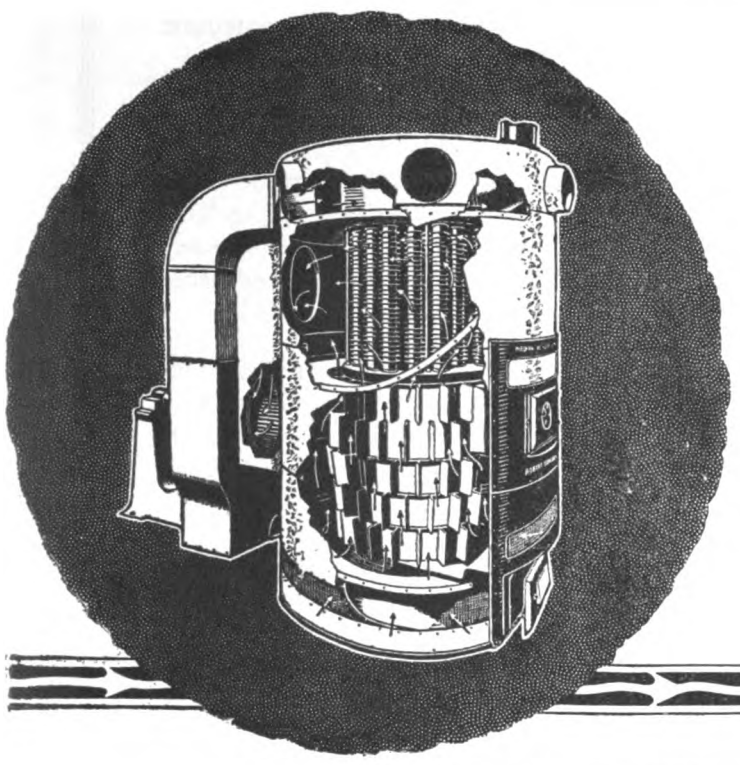
(*Continued from page 70*)

on the third floor. The work tables are covered with glazed roofing tile. There are two double hoods, a work table equipped for electrolytic work, and a draft-proof balance room. On this same floor the work on transformer steel and other alloys is conducted, the equipment comprising a set of small electric furnaces for making alloys, eight small electric muffle furnaces, two vacuum melting furnaces, three electric and two gas melting furnaces, potentiometers and Wheatstone bridges, a Burrows permeability apparatus, storage batteries, two photomicrography outfits, and chemical balances. There is also a metal testing room equipped with a 20,000-pound Olsen testing machine; Erickson tester, Brinnell machine, three fatigue machines, and two electric tool hardening furnaces. On the same floor is apparatus for testing motor and generator brushes, and for testing oil and bearing. There is also a high voltage rectifier equipment and water-cooled X-ray tube outfit for taking X-ray spectra to show the arrangement of atoms in crystalline materials. On the same floor is a room devoted to further improvements in "Water Japan," a non-inflammable japan developed in the laboratory, but now in production in the factory.

Work on lamps and vacuum tubes is done on the fourth floor, the laboratory for this purpose comprising a small but complete factory for the manufacture of lamps with a maximum capacity of about 100 lamps per day. There are four large and four smaller exhaust ovens of standard type, three special ovens for special exhaust, a Thomson welding machine, three sets of apparatus for making arced joints, three for pinched joints, two filament winding machines, an apparatus for making pure nitrogen from tank nitrogen, and a similar apparatus for purifying argon, and a gas density balance. For testing lamps there are three Lummer-Brodhun prism photometers, two portable photometers, one flicker photometer, one Lummer-Brodhun precision photometer, and an optical pyrometer for filament temperatures calibrated up to the melting point of tungsten, 3,450 degrees K., a storage battery, 30 amperes, 144 volts, is used for the photometric work, and two spheres, one 54 inches and the other 10 inches. The life test has a capacity of 60 kw., and facilities are provided for obtaining voltages from 0 to 250 in one-quarter volt steps. A voltage regulator maintains constant voltage on the busbars. Additional circuits are provided for "shop tests" of 120 volts A. C., and 125 and 250 volts D. C., and also an outdoor series circuit of 6.6 amperes equipped with compensators for the high current series lamps. There is also a life test rack with current regulator for street series lamps. Auxiliary testing apparatus provides for the determination of tensile strength, brittleness, and vapor pressure of filaments. Complete outfits are at hand for preparing and treating rods both in hydrogen and in vacuum, and apparatus for photomicrography.

A color booth for studying color values of glasses, apparatus for studying residual gases in vacuum lamps, and apparatus for photographing filaments while burning, are included in the equipment.

On the fourth floor is also the



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This has been proven in numerous foundries, machine shops, and all one-story buildings, where the Sturtevant Hot-Blast Heater is used. It is a complete unit burning hard or soft coal, coke, oil, or gas.

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"We can say that this furnace worked out perfectly satisfactory, but we were fairly assured of this as it was not an experiment with us, as we have already had four others installed and in operation for the past three or four years."

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PUTS AIR TO WORK

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acuum tubes for radio. is permanently equip- circuits and instru- quickly checking the istics of all standard tubes. Another room, which is entirely en- metal screening, is special tests on receiv- es. Still another is for tests on transmit- es up to 20 kw. Two ne equipped with ex- ens, are used for experi- vork in developing new tubes. In one large rk is conducted on va- blems relating to radio, the theory of selective e and loud-speaker de- dark room is provided stigations on photo-elec- s.

e fifth floor part of the lates to high power vac- bes and their applica- High voltage power mers and large reac- and condensers are pro- One room is devoted to dy of vibrations and s in turbines and other es. Here apparatus is d for high speed photog- apable of taking motion s with 1,500 exposures a or single exposures in lionth of a second. Other investigations are also on in another room.

on the fifth floor is the n insulations. Insulating es of many varieties, all of molded compounds, l insulations, enamel for synthetic resins, and materials are receiving nt study and improve- Grinders, mixers, elec- rying ovens, a hydraulic wire enamelling equip- ventilated hoods, are part equipment for this work. re is a life test for vacuum on the fifth floor, and also sembly room for meetings ctures.

t of the work of the re- l laboratory is housed in er buildings. There is a ce building equipped with us types of electric fur- up to two tons capacity. the laboratory has for made all the high speed used in the Schenectady s. Other electric furnace ucts such as titanium car- for magnetic arc elec- s, boron carbide for use as oxidizing flux in casting er, heat-resisting alloys, non-magnetic alloys, are or been regularly produced. There such processes as the graphitizing of carbon brushes and the calorizing of steel have been carried on.

In another building is the work on purification and reduction of tungsten and molybdenum, the two metals used almost exclusively in the construction of X-ray and other vacuum tubes.

One of the primary purposes of the research laboratory is, of course, to glean from the field of science principles and ideas that industry may make of practical value to the world and the world's material work. Another is to seek the solution of problems in manufacturing processes, production and similar matters.

Conspicuous among its achievements in the first mentioned class is the X-ray apparatus devised by Dr. W. D. Coolidge, one of the assistant directors of the laboratory; the various electron tubes it originated, and the gas-filled incandescent lamp known as the Mazda "C" lamp, invented by Dr. I. Langmuir, the other assistant director. In the second are the discovery of the method for making tungsten

Stop up the profit-draining hole of manual load handling

FOR example, it made it possible for one concern to effect a 43% reduction in handling costs.

Many executives have unexpectedly found a surprising number of these "holes," through a casual stroll through the shop or warehouse.

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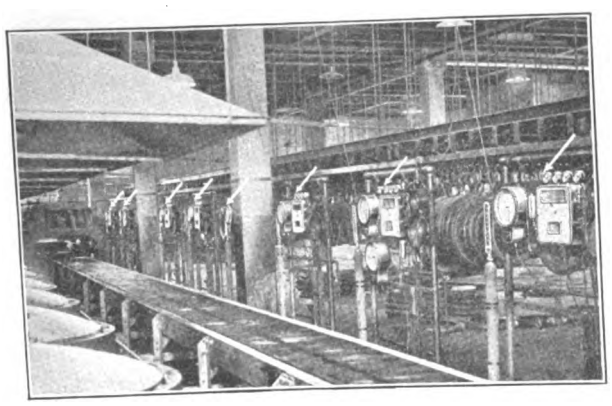
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ductile, with all the revolutionary effect it has had on the process of making incandescent lamps; the magnetite electrode, which alone has survived the competition of the Mazda "C" lamp in street lighting; the method of calorizing steel; the invention of Genelite, a self-lubricating material for bearings; "water japan," a japan without a solvent, the use of which involves no fire hazard; the tungar rectifier for battery charging; "sheath wire," with mineral insulation used in heating devices; the heat-resisting alloy "Calite"; and the Langmuir vacuum pump, which produces the highest known vacuum.

Thus every real addition to our knowledge, whether it is a fundamental discovery, revolutionizing scientific thought, like Thomson's discovery of the electron, or the explanation of a baffling phenomenon by the establishing of a new principle, like Langmuir's "space charge law," or learning how to do something before impossible, like the production of high vacuum, or the mechanical working of tungsten, leads almost invariably to new devices, new arts, new manufactures, and new comforts or conveniences for mankind, and these ultimate results are seldom foreseen while the research is in progress.

It is for this reason among others that we always in our laboratory encourage much research that has little or no immediate application to practical problems, confident that if the work is well done the practical justification will follow. I could cite many illustrations of the justification of our faith, but Langmuir's work on the Edison effect is as good a case as any.

I do not mean that we scorn practical problems. The greater part of our work is directed to the solution of such problems. Some factory has run into trouble and asks to be pulled out. Some designing engineer needs a new alloy or new molded compound with certain properties and asks us to develop it for him. Such appeals always have first claim on our efforts, whether the answer comes in a few hours or in many months. Sometimes these bread and butter jobs bring results of scientific interest and wide application.

Again a large part of our work consists of attempts to improve our products. Most of

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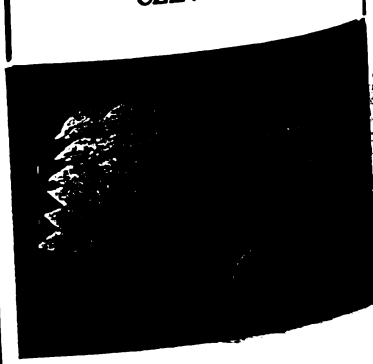
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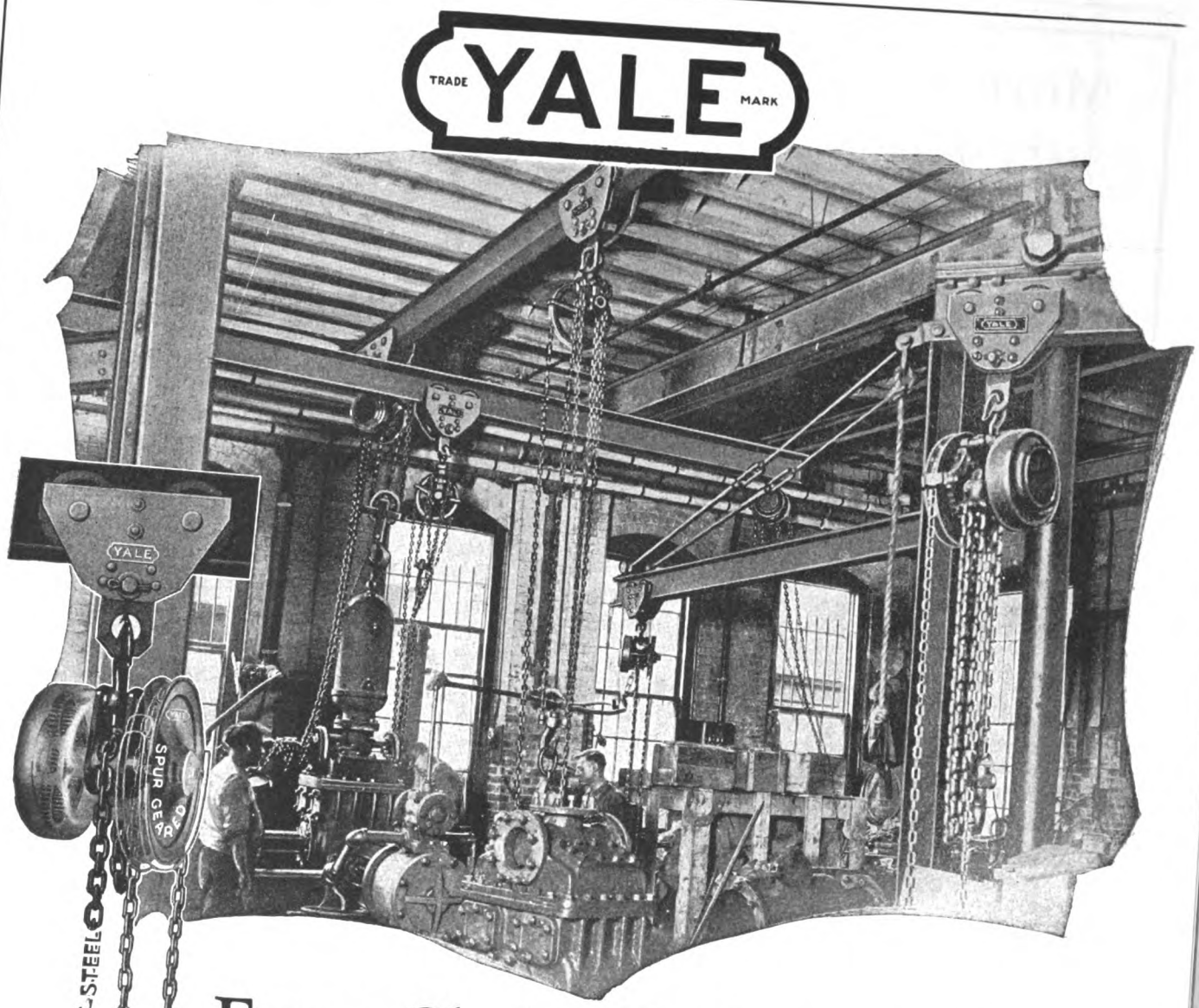
that work originates in the laboratory. We have groups continually at work on incandescent lamps, radio tubes, X-ray tubes, transformer steel, alloys, molded compounds, insulating varnish, lubrication problems, etc.

Again it is frequently necessary or desirable for the laboratory to develop and manufacture for a time some new material or device before turning it over to a factory department. This was done with drawn tungsten wire, magnetite electrodes, X-ray tubes, radio tubes, several different insulating materials, etc.

We regard it as our primary duty to serve the company that supports us by helping other departments in all possible ways to improve their products and manufacturing methods, and to increase the scope of the company's business by developing new devices and materials. But always we devote as much effort as possible to pure science. Each kind of work helps the other. Science is always yielding new riches to be practically developed, and the contact with practical things helps the scientific worker to keep his perspective. The two advantages an industrial laboratory has over a college laboratory are, first, greater facilities for getting things made, and, second, the close contact with real problems. You remember the Greek myth of Antaeus who gained strength from each contact with Mother Earth. Meredith in poetry and prose reiterates the same thought, that humanity must "touch earth" to keep health and sane. That contact is as salutary for science as for human nature. Because of these advantages the industrial laboratory should play an increasing part in the advancement of science.

But a large industrial laboratory must be a growth. It is said that Athena, goddess of science, sprang full grown and fully armed from the brain of Zeus, but we cannot do that sort of thing nowadays. The failures I spoke of earlier were the result of attempts to begin with a full grown laboratory. No man ever lived who could take a big new laboratory and make a success of it. The successful laboratory is built of men, and true research men, like true poets or true artists, are hard to find. Men with promise must diligently be sought, and as they are found one by one their special aptitudes must be developed and the right problems fitted to these aptitudes.

To an engineer that statement may sound overdrawn. I find few engineers recognize the wide difference between engineering and research, but the difference is very wide. It is very seldom that aptitude for both are found in one man. The mental attitude required is fundamentally different. The engineer is the type that likes to deal with certainties. He likes to utilize known materials, whose properties he knows and has confidence in, and to produce therefrom concrete results in the way of new structures, new devices. He likes to see the tangible result of his labors. The research man is primarily interested in the unknown. He seldom has the patience to carry a new idea through to a finished design. He differs from the engineer as the pioneer differs from those who come after him to develop what he has found. Kipling well expresses that ceaseless urge toward the un-



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AT the plant, illustrated above, of a leading pump manufacturing company located in Brooklyn, New York, Yale Spur-Geared and Screw-Geared Chain Blocks suspended from I-beam trolleys are used for all lifting and transporting of heavy machinery throughout the works.

The management considers the system an ideal and highly efficient means of handling materials and has for many years specified Yale Chain Blocks exclusively.

Of the utmost importance in this, as in all other installations, is the question of safety. Yale Chain Blocks, "from hook to hook a line of steel," have unquestioned strength in each component part. Their use eliminates any chance of failure. The load hook designed to open up gradually under an excessive overload, is the "safety-valve" that prevents accidents through an operator's negligence.

Yale Chain Blocks, requiring for their best work only periodical oiling, perform the same highly efficient service year after year.

Service considered, Yale equipment is decidedly a good investment.

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YALE Hoisting and Conveying Systems

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known, in his poem, "The Explorer":

"Till a voice, as bad as Conscience, rang interminable changes
On one everlasting whisper day and night repeated, so:
'Something hidden, go and find it. Go and look behind the range.
Something lost behind the ranges. Lost and waiting for you. Go'—"

It is this restlessness in the face of the unknown, that trait which Kipling elsewhere characterizes as "insatiable curiosity" which marks the research man, but to be successful he must also have the gift of observing and questioning even the commonplace. Just as to the poet "a primrose by the river's brim" was "something more," so the spreading of oil on a river's surface, which was to others merely a pretty irridescence or an obnoxious fouling of the water, was to Langmuir a method of measuring the exact dimensions of the oil molecule, and distinguishing one oil from another. The research man also needs the scientific imagination to construct hypotheses, the analytical ability to devise the crucial experiments to test the hypotheses, the resourcefulness, manipulative skill, and persistence to carry through the experiment, the perspective which distinguishes the essential from the non-essential, and the reasoning which coördinates individual facts into a principle.

We need to seek such men, and in Capt. Cuttle's language, "When found, make a note of." We need such men in industrial laboratories, but we need them equally in colleges and universities, to inspire and to train students with aptitude for research. With the necessary effort, the men can be found and research widely developed. Germany has shown it can be done, and the British Empire and the United States should be able to outstrip Germany, for we have one thing that the German lacks, the inborn spirit of team play. In the German laboratories before the war, each laboratory room was under lock and key. No one but the general manager knew what was going on outside of his own room. We don't do things that way. We can coöperate without jealous friction, for the good of the team, and in that way the output rises nearly in geometric proportion to the number of workers, for each helps all the others. Research will do for all our industries what it has already done for the General Electric Company and others. And if ever another war comes, as we pray it will not, our large industrial laboratories will be among our greatest military assets. Some nine months after the United States entered the World War, a visitor from the British Admiralty to our laboratory commented on the speed, to him remarkable, in getting our submarine detectors developed and into quantity production, and he attributed our advantage over England in this respect to the fact that our physicists, designing engineers, and factory men were all trained through years of peaceful development to work as a team with huge resources to back their efforts. The next war, if it comes, will more than ever before be a war of applied science.

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Mr. Emerson's book will ever rank as a classic among the great books on Management because it deals only with the twelve supreme principles—principles that are so definite, so constant, so true, that they may be used as gauges of individual and plant efficiency of any time, any industry or any set of conditions.

It reduces the doctrine of efficiency to a code upon which to base rules of practice, a code that will be as serviceable in determining how efficient a man or a method is years from now as it is today.

Five of these principles concern relations between men—between employer and employee; seven of them concern methods or institutions or systems established in the manufacturing plant or in the operating or distributing company.

The chapter headings are as follows: 1. Organization and Principles the Prime Instruments for Efficiency. 2 The Type of Organizations Through which Efficiency is Attained. 3. The First Principle—Clearly Defined Ideals. 4. The Second Principle—Common Sense. 5. The Third Principle—Competent Counsel. 6. The Fourth Principle—Discipline. 7. The Fifth Principle—The Fair Deal. 8. The Sixth Principle—Reliable, Immediate and Accurate Records. 9. The Seventh Principle—Despatching. 10. The Eighth Principle—Standards and Schedules. 11. The Ninth Principle—Standardized conditions. 12. The Tenth Principle—Standardized Operations. 13. The Eleventh Principle—Written Standard Practice Instructions. 14. The Twelfth Principle—Efficiency Reward. 15. Efficiency Principles Applied to Measurement and Cure of Wastes. 16. Executive Control of Line and Staff.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, Etc., required by the Act of Congress of August 24, 1912, of INDUSTRY ILLUSTRATED, published monthly at Cooperstown, N. Y., for October 1, 1923. State of New York, County of New York, ss.

Before me, a Notary Public in and for the State and County aforesaid, personally appeared John H. Van Deventer, who, having been duly sworn according to law, deposes and says that he is the President of the INDUSTRY ILLUSTRATED, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Engineering Magazine Company, Coopers-town, N. Y.; editor, John H. Van Deventer, Cooperstown, N. Y.; managing editor, none; business manager, Harvey Conover, Jr., Cooperstown, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.) Engineering Magazine Company, Cooperstown, N. Y.; John R. Dunlap, Cooperstown, N. Y.; J. R. Dunlap, Jr., New York, N. Y.; John H. Van Deventer, Cooperstown, N. Y.; Harvey Conover, Jr., Cooperstown, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN H. VAN DEVENTER.

Sworn to and subscribed before me this 2nd day of October, 1923.

CHAS. R. GOETZ.

(My commission expires March 30, 1924.)

Is Industry a "Cold, Relentless" Machine?

(*Continued from page 9*)

which American engineers are leading.

"There is a distinct movement among our industries toward giving the men a greater voice in the management, toward securing for the employees representation with the management in the consideration of problems of mutual interest.

"There is a sincere effort being made to give every man the benefit of the economies and the improvements which his efforts make possible, and great progress is being realized in making the men understand that their interests and the interests of the corporation with whom they work are the same.

"No more striking illustration of the possibilities in this direction has been recently given than the experience of Armour & Co., who, a few days ago, made an offer of the stock of their company to their fifty thousand employees, and out of the fifty thousand employees I am told some forty thousand subscribed to the stock—truly a remarkable exhibition.

"Another instance of national importance in securing coöperation between management and employees is being worked out in the great Pennsylvania Railroad under the leadership of General Atterbury. The confidence which the employees of the Pennsylvania Railroad manifest in General Atterbury and the men under him, most of them engineers, is one of the milestones in this movement toward successful human engineering.

"There are many other organizations, many groups of men, in this country engaged in this movement toward the perfection of human engineering, and it is a movement which will promote not alone the material well being of our civilization, a movement which will continue to produce big things, but is also a movement in which American engineers can well take even greater pride, for the production of great men."

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You have plenty machines that do their work automatically. But none do their *best* automatically.

That "best" may be reached by recording the best you begin with—progressing then to *higher* records by improved mechanics and operating methods.

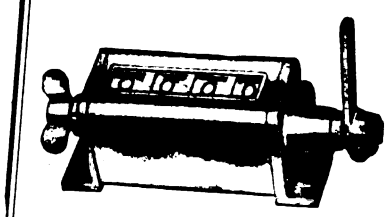
Your out-of-ordinary production is built up and kept up by *records*. And your master tool for building them *high*—is a

Veeder COUNTER

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable to experimental work. If run backward the counter subtracts. Price $2.00. (*Cut 3/5 size.*) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also $2.00.

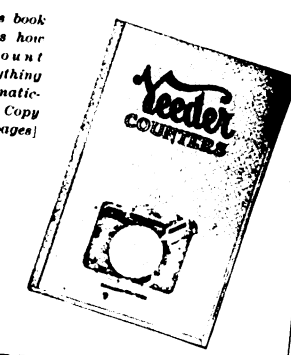


The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten-figure wheels, as required. Price with four - figure wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter to record reciprocating movements as on punch presses, $11.50 (list).

This book shows how to count everything automatically. Copy [80 pages] Free.



The Veeder Mfg. Co.

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Salary List, or Pay Roll?

By K. M. Coolbaugh

Superintendent, State Employment Office, Philadelphia

THE other day the telephone rang and an old customer up the State, who is the power distribution superintendent of a large interurban traction line, was at the other end of the wire.

"I want eight linemen for the same class of work as that for which you got us men about two years ago. We are building an extension and want them for permanent work. If you can, line up about ten or fifteen for me and I will be down Monday to interview them."

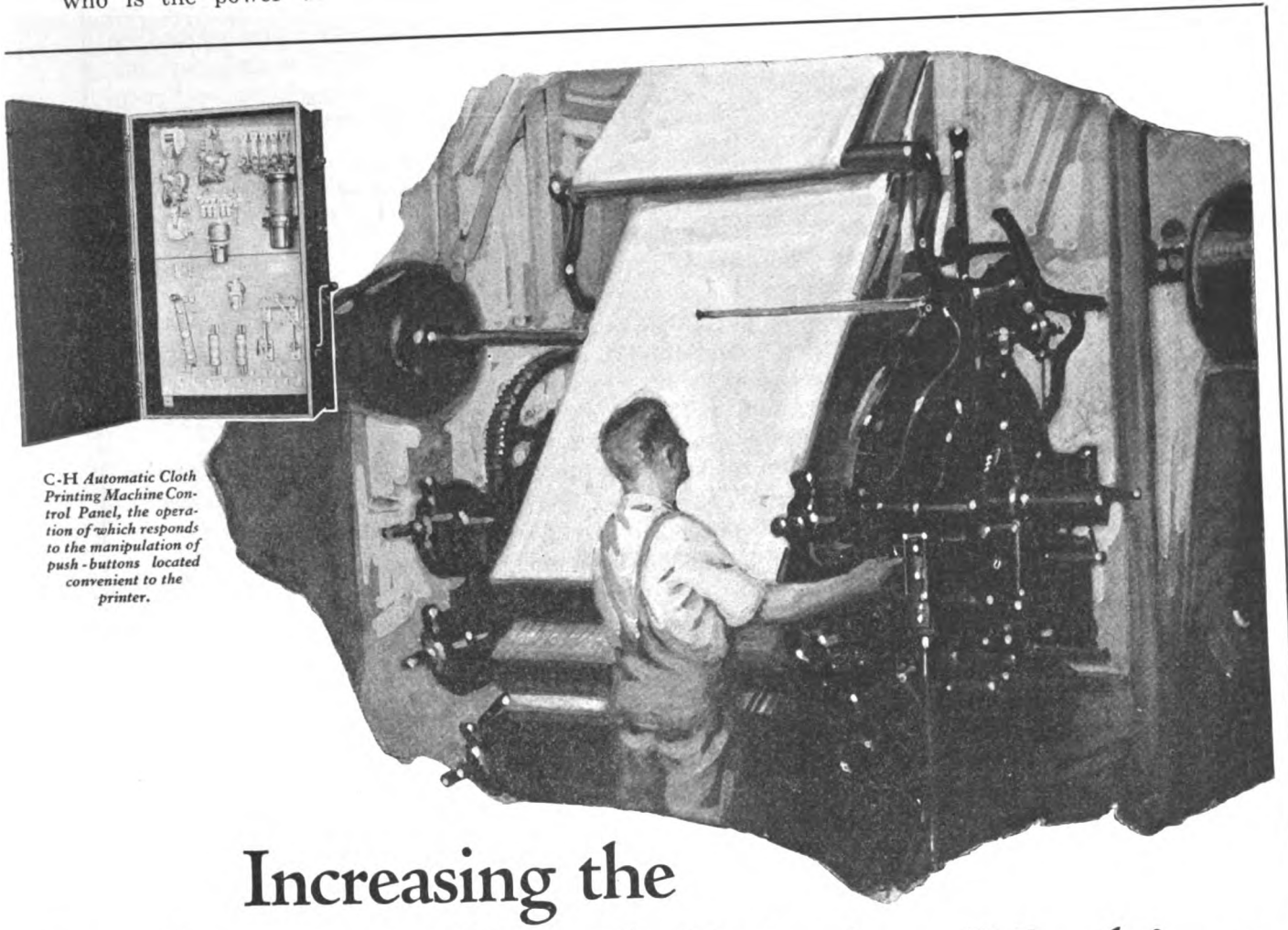
I gave the order no more special thought than the usual run of orders which come to the office daily by letter, telephone and personal calls.

But the following Monday morning the traction official came to our offices, was assigned to a room for interviewing the men, whom we had procured for him, and at once started the sifting out process. And later in the day I learned he had interviewed ten applicants, eight of whom he had hired. The wages which he offered were substantially no higher than those paid locally, so that when he came up to my office to say good-bye before leaving with six of his new employees, I was led to ask him how he had obtained these men so quickly.

He smiled and replied: "It wasn't the rate that got them: it was the proposition!"

Here is his proposition as he outlined it to me:

"Any transportation man knows how vital maintenance men, and especially linemen or trouble shooters, are to railway operation. For years we fiddled around with hourly rates, bonuses, time and a half, double time, and Heaven knows what. We spent more time in trying to arrive at a satisfactory wage agreement with our linemen than has been wasted in Senate filibusters. The keenest sharks at figures we could obtain sat up in conferences night after night with representatives of the linemen. They arrived at I don't know how many agreements which were endorsed, sealed and delivered with as much good faith on the part of the employees' representatives as upon the part of the management. They seemed to lead us nowhere. It was not usually the question of the base hourly rate that apparently caused our disagreements and misunderstandings; in ninety per cent. of the cases it was our inability to work out the question of overtime, Saturday afternoon, Sunday and holiday work to complete satisfaction.



C-H *Automatic Cloth Printing Machine Control Panel, the operation of which responds to the manipulation of push-buttons located convenient to the printer.*

Increasing the Production of Cloth Printing Machines

In the development and application of motor control apparatus where peculiar and involved requirements are found, the experience and skill of Cutler-Hammer Control engineers are particularly valuable.

The involved requirements of drive and control of textile printing machines are met by C-H Cloth Printing Machine Controllers—which give the printer push-button automatic control in which are incorporated all features required for good daily output.

The printer after determining the number of yards to be printed per hour, and the number of colors, can set the controller for maximum speed with the above conditions in mind. Pressing the "Start" button is then all he needs to think of—because the C-H Automatic Control Panel (mounted up out of the way) directs and takes care of the proper acceleration—and always brings the machine up to the speed for which it is set.

This Cloth Printing Controller also provides dynamic braking for quick stops—insures full field when starting so as to supply necessary torque—allows the printer to "inch" and thread at one-half normal speed, and to slow down to this speed—all by means of properly tagged push-buttons placed convenient to his hand.

In fact, the printer need know nothing more about the controller than the push-buttons—and therefore devotes all of his time to his work.

To users of textile machinery and manufacturers of motor-driven machines, our experience of over a quarter of a century is available. C-H motor control apparatus is made for every kind of motor drive. Economies in production and elimination of delays are possible through application of the proper type of control. Engineers in our branch offices are ready to assist you at any time.

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C-H CUTLER-HAMMER AUTOMATIC CONTROLLERS FOR CLOTH PRINTING MACHINERY

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ou hit upon your salary proposition!" I

y we did," he went on, as come nearer to solv- of my so-called labor than any move I have was because I offered ght men whom I em- oday a monthly salary ey can bank on in spite ing and high water that pped at the job. As a of fact, we threw the ate proposition so far fects linemen into the a year ago. It hap- his way: Traffic was th us and we were com- drop a number of our was sick and tired dick- I told the linemen I pay them a straight salary which they eceive once a week; that uld bank on that salary n and month out so long iad need for their serv- so long as they did the I named a salary which was about $20.00 less nth than they had been ng on an hourly basis. early took me off my feet epting the proposition. s the result today? For our entire force of line- ve worked on a straight basis, precisely as I, all ce employees and the offi- f the company work. It d them up to the com- nd to their job tighter y means so far attempted gested. I am so com- sold to the salary basis employees, regardless of ob, that if it were prac- and agreeable to all em- s of our company I would in force tomorrow morn-

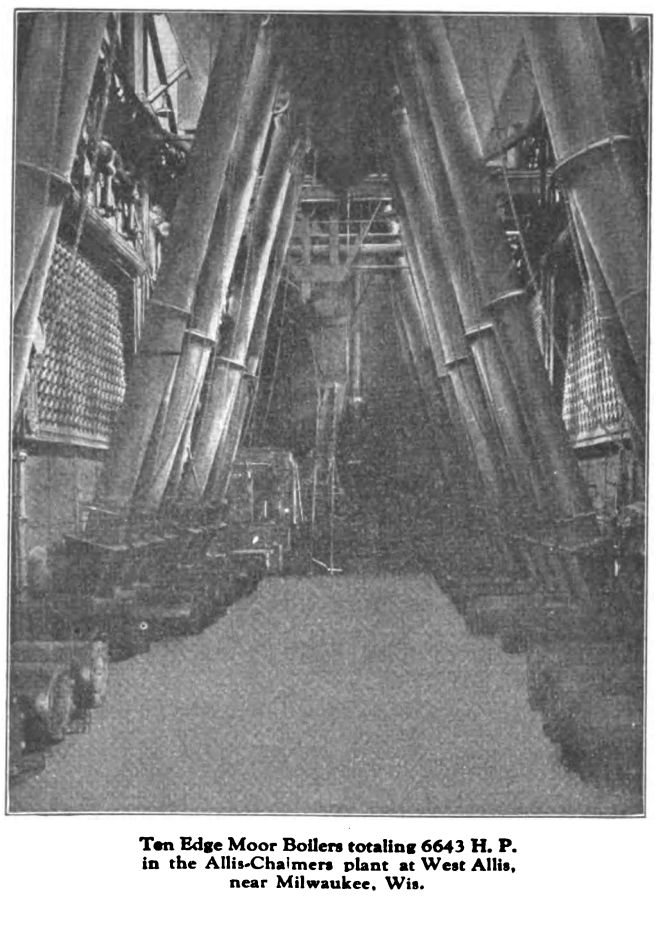
fore we instituted the sal- ea, our linemen seemed to but one thought in mind: vas how to make the great- nount of overtime. There d to be a conspiracy to r on the job for eight hours aight time and then obtain ch work as possible Satur- afternoon at time and a and Sundays and holidays uble time. They were out t all the traffic could stand. not blaming them at all. ven't a doubt that clerks probably many executives d resort to the same ques- ble practice if they were on ourly basis and could see a ce to make more money by ering and stringing the job g. Believe me, these men it down to a science.

"All that is past. Today nearly every one of these men is a company man from the word go. They are out to give the best that is in them in the shortest time possible. They seem to have a mania for shooting trouble wherever it shows its head; and like the Northwest Mounted Police, when they shoot it's usually only once at the same target and then they are waiting for more trouble. Night work, Sunday work, in fact nearly all work which we formerly classed as overtime is no longer performed, except in time of great emergency.

"But how do you apportion your overtime and emergency work?" I interrupted. "Isn't there friction and hard feeling when one of your linemen has to go out on a hurry call at night, or on the Fourth of July?"

"There hasn't been a kick worthy of the name," he answered. "If a lineman does a job during hours which were formerly classed as overtime, he is entitled to a lay off on a week day time equivalent to the hours in which he did emergency

ALLIS-CHALMERS and EDGE MOOR



Ten Edge Moor Boilers totaling 6643 H. P. in the Allis-Chalmers plant at West Allis, near Milwaukee, Wis.

THE Allis-Chalmers Manufacturing Company, one of the best-known makers of machinery and electrical equipment "complete from prime mover to switchboard," is a thoroughly competent judge of all power plant equipment.

Installed with Allis-Chalmers products, in the Company's large plant at Milwaukee, are eleven Edge Moor Boilers, furnishing the steam for the manufacture of other Allis-Chalmers equipment.

Purchased over a period of eighteen years, these eleven boilers represent five separate orders. The efficient performance of the first Edge Moors was responsible for subsequent orders.

In scores of industries, users of power, large and small, find in the Edge Moor Boiler the solution of their steam generation problems. Complete information is given in the Edge Moor Catalogue, a copy of which will be promptly sent at your request.

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EDGE MOOR Water Tube BOILERS

FOR INCREASED FUEL ECONOMY

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work. For instance, if Sunday work is necessary, a man can pick out his day off during the following week. Instead of a conspiracy or a gentlemen's agreement, if you want to call it that, to increase the pay envelope as in the old days, each man takes it on himself to see that every other man does an honest day's work and carries his share of the load. We have weeded out only two of our entire force during the past year. Those two men were dismissed, not because of delinquencies reported by their foreman, but because they had become so unpopular with the rest of the crew for soldiering on the job that common sense and fairness to those who were doing the work dictated their removal from the payroll; in fact, the recommendation for dropping those two men came from their fellow workers.

"Yes, sir," he concluded, "I am for the straight salary proposition, and I am bending every effort to have it cover every job in my department. It will take time, but because it takes time, the job, when it is finished, will be well done."

Two days later when he telephoned me to place an order with the office for a number of technically trained engineers, I asked him whether all of the men whom he had employed on the previous Monday had shown up at the railway station at the appointed time for leaving.

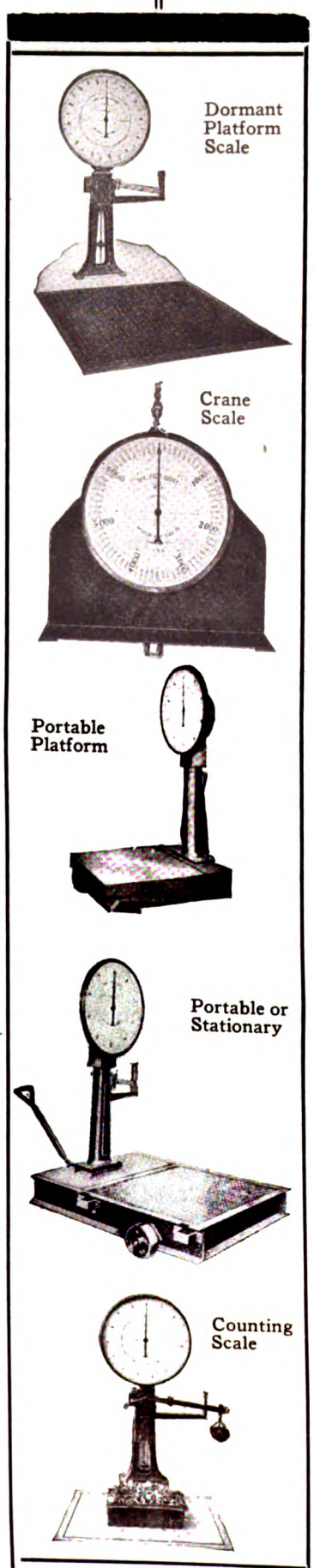
"The six not only showed up, but this morning I got a letter from the two men whom I had employed that wanted to serve out a ten-day notice with their present employers, asking me to be sure to hold their jobs open."

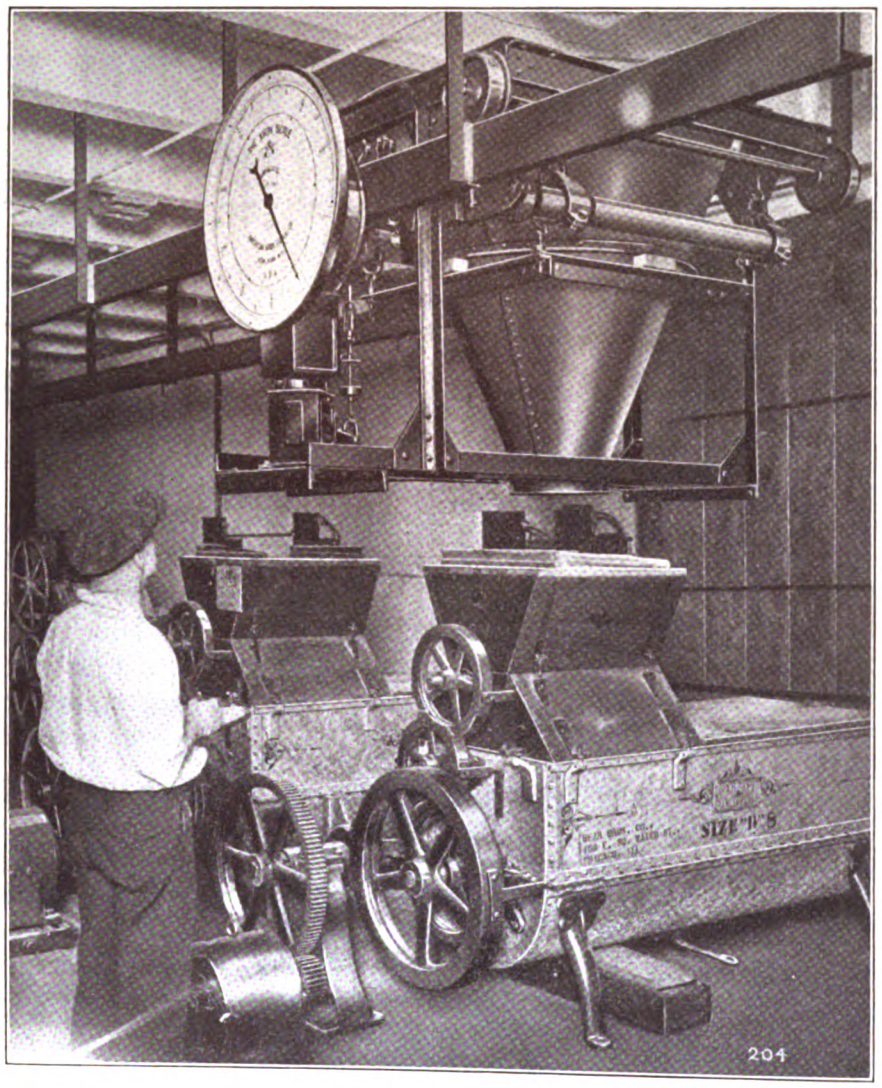
All men who have engaged in employment work and the recruiting of labor during periods of great business prosperity and its concurrent labor shortage know only too well how small is the percentage of mechanics whom they employ who actually show up for shipment to the job or appear at the appointed time at the plant employment office. Employment men who have been in the business any length of time frequently engage twenty-five, or in some cases fifty per cent. more men than they are actually seeking. They do this with the firm conviction that the surplus will change their minds.

It is for this reason that the experience of this traction superintendent interested me especially, because I know that what he had to offer must have been of paramount interest to the eight men employed, all of whom had kept their promises. His experience is all the more significant because it took place in a period of acute labor shortage, when all around him employment men and labor agents were engaging ten mechanics when they wanted five, or fifty common laborers when they wanted ten.

The incident is one of the few in the records of this office where all of the men engaged by an employer actually showed up on the job ready to work.

Whether we wish to admit it or not, there is and always has been a line, tangible but invisible, which separates the man in the shop from the man in the office. There is but one sound reason for the existence of this line. That reason, as I see it, is the distinction, arbitrary or necessary, which the hourly wage basis and the salary basis of themselves create. It is the result of placing two sharply contrasting ideas side by side. It is one of our industrial Ma- son and Dixon lines which will





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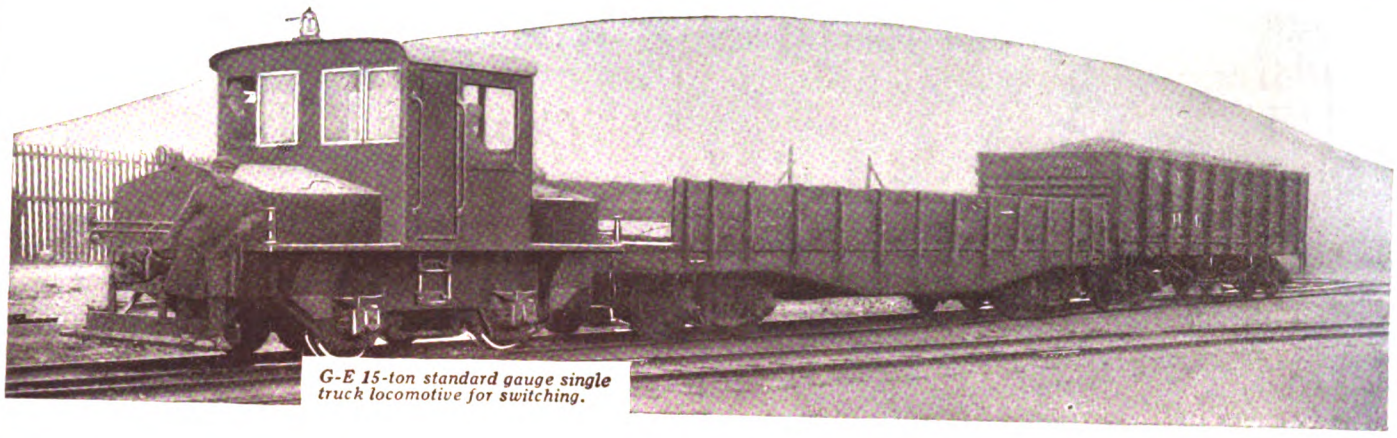
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road toward this goal,
however, is most difficult to travel when an attempt is made to apply the principle or method in the building and construction field. Many factors block it at every turn, such as weather conditions, the keen competition for labor resulting in a heavy labor turnover, and constant wage re-adjustments, due to causes with which every contractor and builder is familiar.

Nevertheless, I have even in those industries seen this tendency to transfer mechanics from an hourly to a salary basis show itself more often during each succeeding year of construction activity.

After all, Industry's greatest problems are not of commodities and their markets. They are problems of human nature. And strangely it is a poet, not a business man, who has given us in one short line a fundamental industrial philosophy which in its broadest sense some of us do not comprehend in a life time:

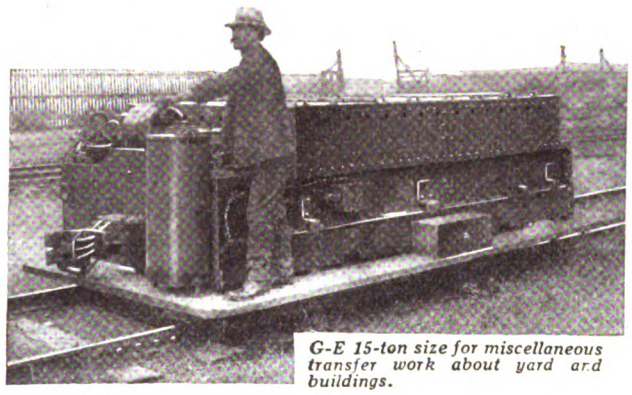
"The Colonel's Lady and Judy O'Grady
Are sisters under their skins."



G-E 15-ton standard gauge single truck locomotive for switching.



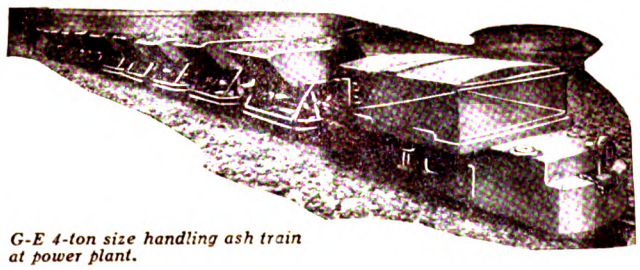
G-E 40-ton combination storage battery and trolley locomotive for heavy duty yard service.



G-E 15-ton size for miscellaneous transfer work about yard and buildings.



G-E 10-ton platform capacity type for exchanging material between buildings.



G-E 4-ton size handling ash train at power plant.

There Are Many Uses For G-E Storage Battery Locomotives

Whether switching loaded freight cars—transferring raw material, or partially finished products from building to building—hauling ashes or refuse—G-E Storage Battery Locomotives speed up production through facilitating transportation of materials.

With this type of electric locomotive, neither trolley nor third rail is required—and it is possible to reach points in shops, yard or mill where the use of other methods of haulage is not feasible. A G-E Storage Battery Locomotive can be run inside of building and in other localities where the smoke and fire risk of a steam locomotive would forbid its use.

The large type G-E Storage Battery Locomotives are now demonstrating that the yard shifting work in industries can be handled at a lower cost per ton mile.

Interesting and valuable detail of the uses of electric locomotives for industrial haulage is contained in *Bulletin No. 44251* which will be mailed you free upon your request. Write for it today.

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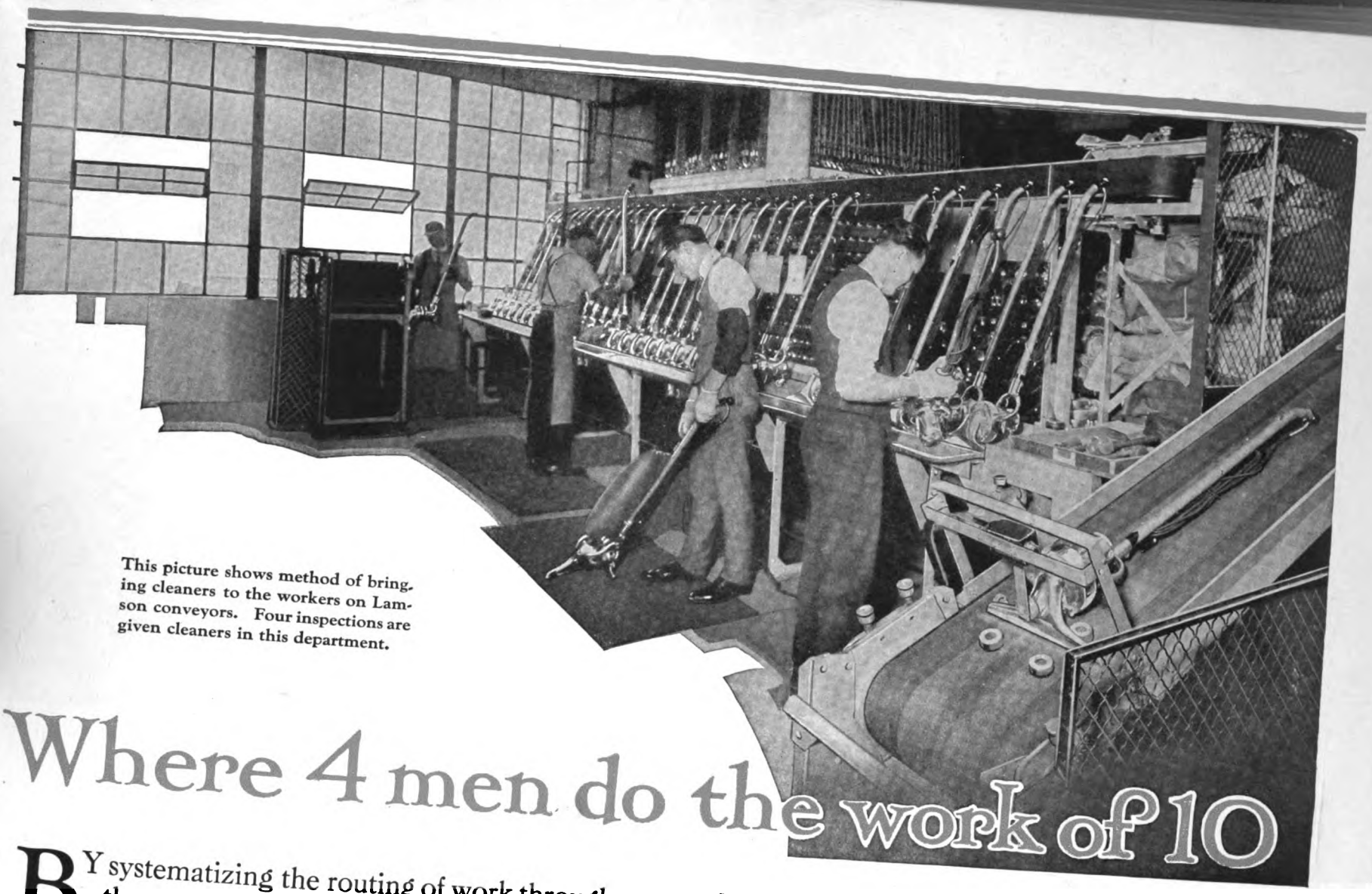
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This picture shows method of bringing cleaners to the workers on Lamson conveyors. Four inspections are given cleaners in this department.

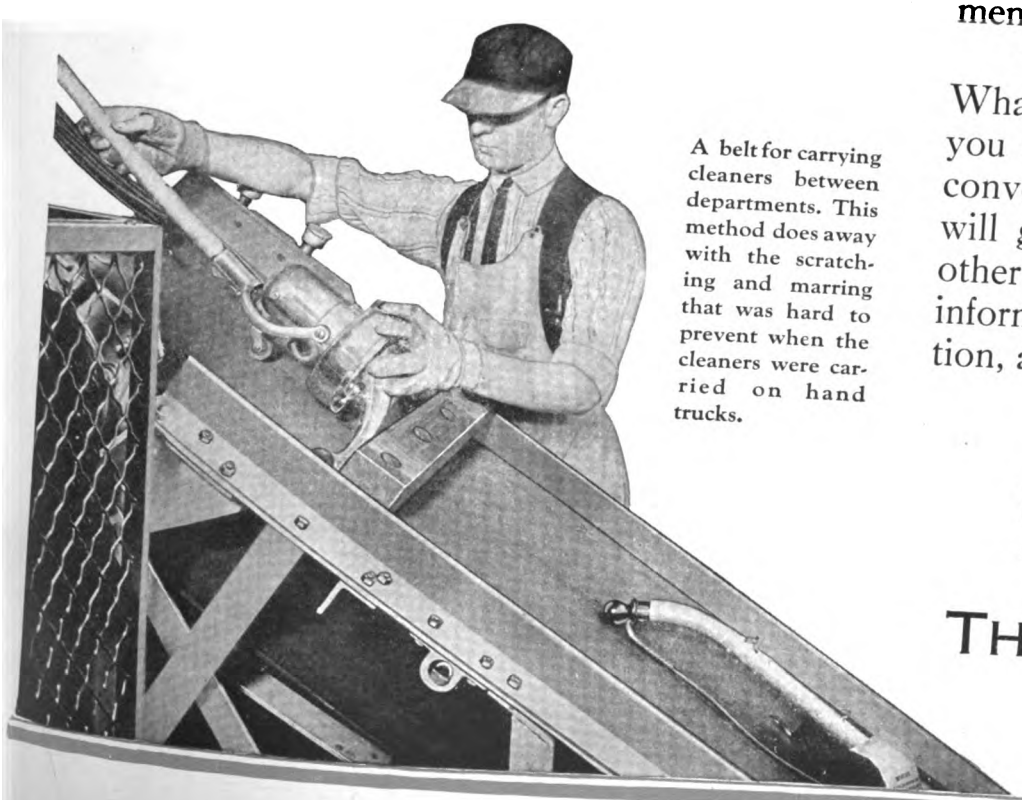
Where 4 men do the work of 10

BY systematizing the routing of work through the assembly, inspection, and packing departments, and applying Lamson conveyors to carry out the new routing plans; the Eureka Vacuum Cleaner Company, Detroit, Mich., was able to make remarkable savings. The assembly conveyor cut down the number of operators from ten to four, and earned its cost the first month that it was in use.

The conveyors serve as a pacemaker of production. By adjusting their speed, the output can be increased or lowered, at will. The workmen are enthusiastic about the conveyor. Their work is simplified and lightened, while their greater output enables them to earn more.

The system is far more than a mere handling device—rather it is a mechanical means for introducing production control into the departments where it is installed.

This plan is easily applied to any business. Whatever your production problem, it will pay you to discuss it with a Lamson engineer. If conveyors will solve it, he will tell you how; he will give you the cost, and will explain all the other points on which you will surely want more information. An interview will incur no obligation, and may point the way to substantial saving.



A belt for carrying cleaners between departments. This method does away with the scratching and marring that was hard to prevent when the cleaners were carried on hand trucks.

Send for our booklet, just off the press, containing complete description of this system by Mr. A. G. MacLaren, Factory Superintendent, The Eureka Vacuum Cleaner Company.

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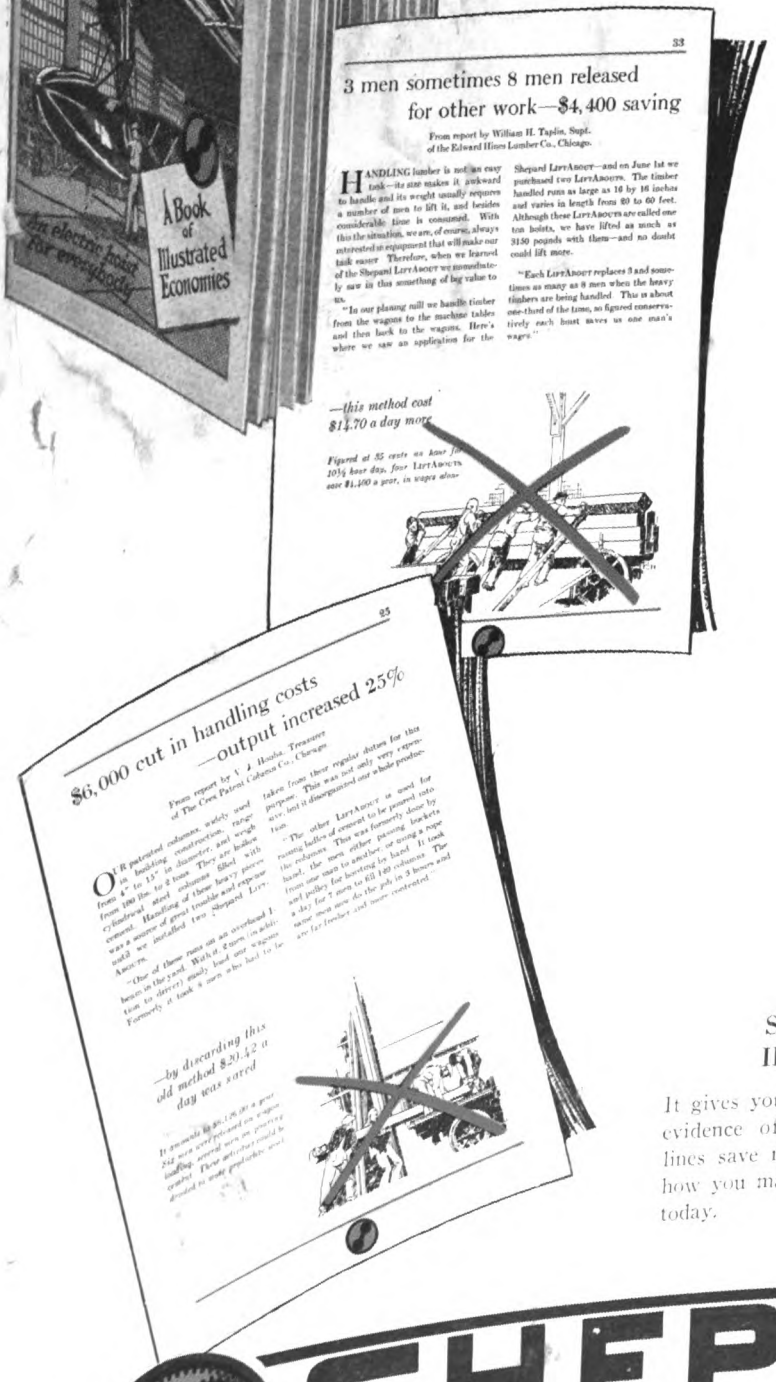
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LIFTABOUT BOOK OF ILLUSTRATED ECONOMIES

Dependability + wide application
+ low cost of operation
= An electric hoist for everybody





33

3 men sometimes 8 men released for other work—$4,400 saving

From report by William H. Taplin, Supt. of the Edward Hines Lumber Co., Chicago.

HANDLING lumber is not an easy task—its size makes it awkward to handle and its weight usually requires a number of men to lift it, and besides considerable time is consumed. With this the situation, we are, of course, always interested in equipment that will make our task easier. Therefore, when we learned of the Shepard LIFTABOUT we immediately saw in this something of big value to us.

"In our planing mill we handle timber from the wagons to the machine tables and then back to the wagons. Here's where we saw an application for the Shepard LIFTABOUT—and on June 1st we purchased two LIFTABOUTS. The timber handled runs as large as 16 by 16 inches and varies in length from 40 to 60 feet. Although these LIFTABOUTS are called one ton hoists, we have lifted as much as 3150 pounds with them—and no doubt could lift more.

"Each LIFTABOUT replaces 3 and sometimes as many as 8 men when the heavy timbers are being handled. This is about one-third of the time, so figured conservatively each hoist saves us one man's wages."

—this method cost $14.70 a day more

Figured at 35 cents an hour for 10½ hour day, four LIFTABOUTS save $4,400 a year, in wages alone

35

$6,000 cut in handling costs —output increased 25%

From report by T. J. Hooks, Treasurer of The Cree Patent Column Co., Chicago

OUR patented columns, widely used in building construction, range from 4" to 15" in diameter, and weigh from 100 lbs. to 2 tons. They are hollow centrifugal steel columns filled with cement. Handling of these heavy pieces was a source of great trouble and expense until we installed two Shepard LIFTABOUTS.

"One of these runs on an overhead I-beam in the yard. With it, 2 men can handle to discard easily load our wagons. Formerly it took 4 men who had to be taken from their regular duties for this purpose. This was not only very expensive, but it disorganized our whole position-

—by discarding this old method $20.42 a day was saved

Logic of the LIFTABOUT

Logically our LIFTABOUT is "an electric hoist for everybody."

1. It's a very dependable piece of equipment—of proven hoist design, with the same principles of construction that make "Shepards" the most widely used hoists in America.

2. Its use is practically unlimited. It seems to just "fit" in most every business or industry that moves or lifts loads.

3. Its cost of operation is negligible. Its first cost, too, is remarkably low, and this is due to standardized manufacture and quantity production.

The LIFTABOUT operates on overhead track, takes up no valuable floor space—always instantly available for moving loads, hot or cold, bulky or fragile, or loads of any description. It is sure, safe, fool-proof in the hands of any one. It may be just what you've long wanted to put your load-moving and lifting on a really economical basis.

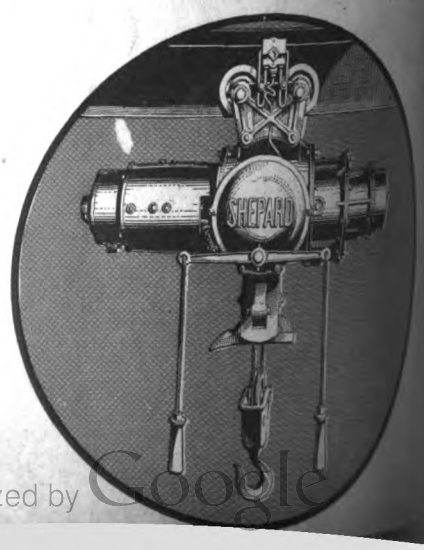
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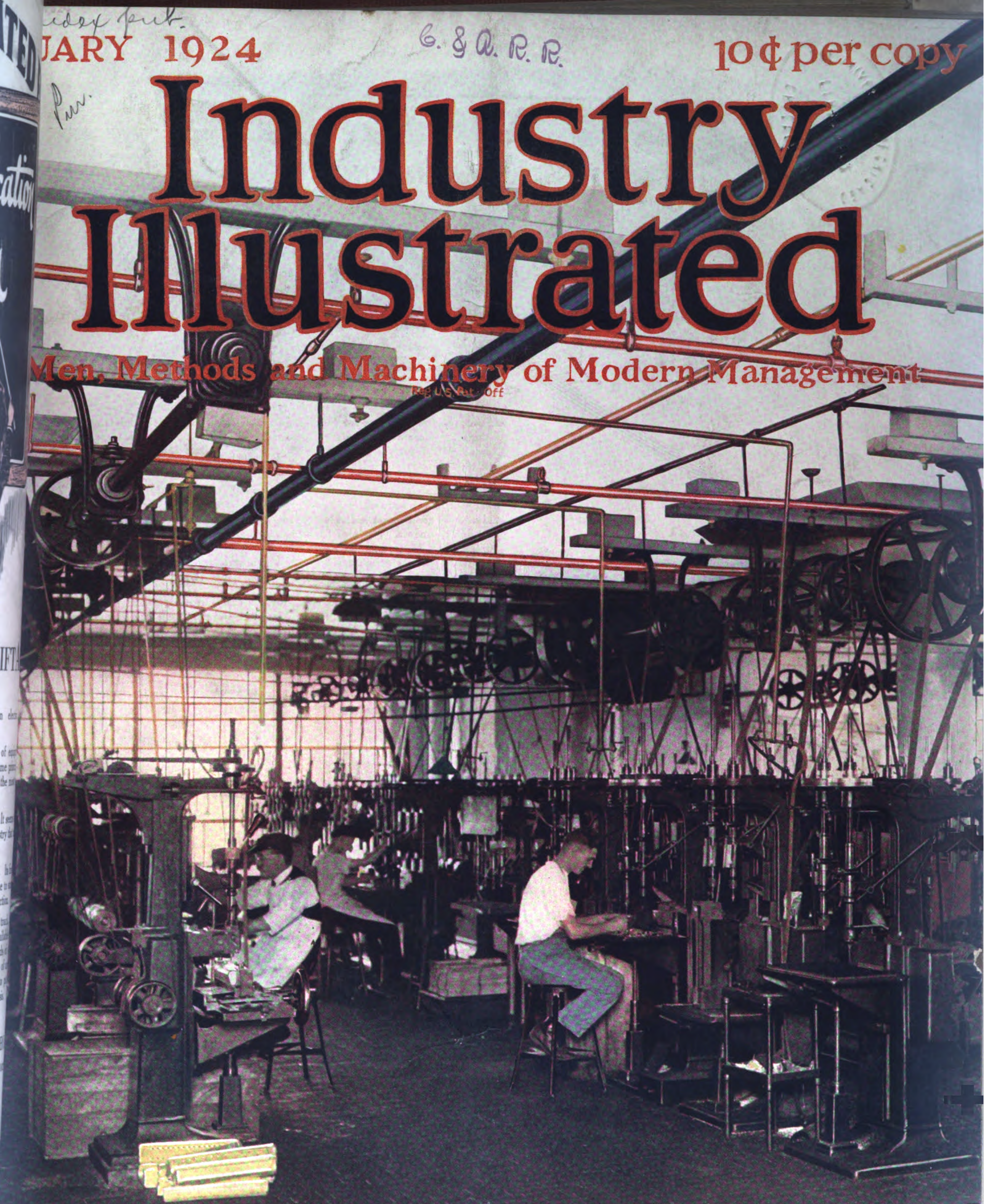
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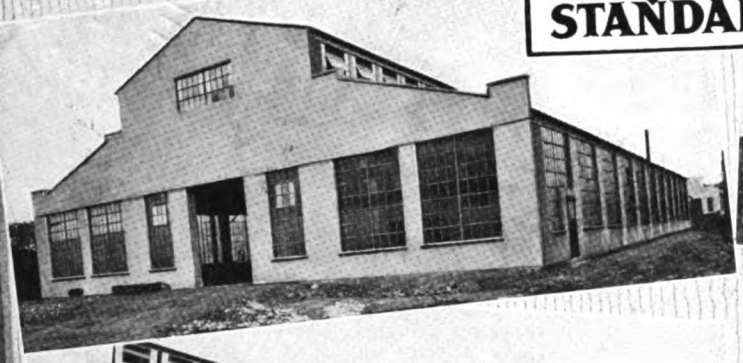


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What Paint Means to Maintenance

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COPPER STEEL STANDARD BUILDINGS









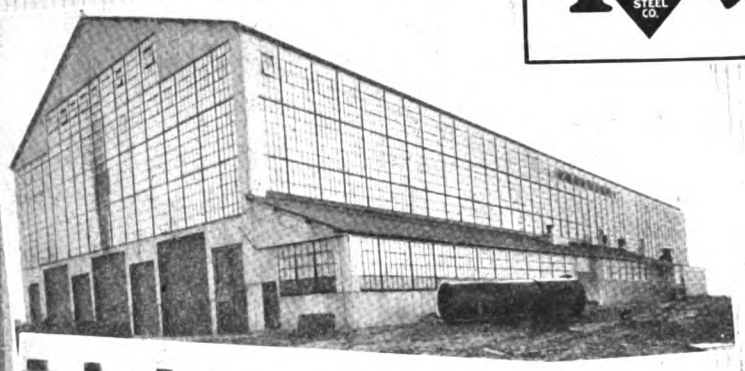
Building for Bigger Business in 1924

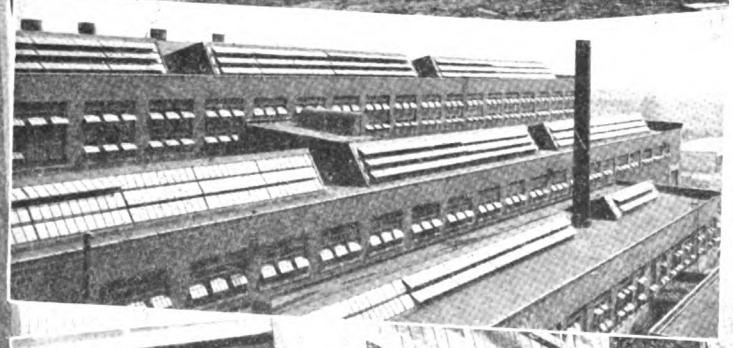
Forecasts for 1924 are for increased business, and industrial leaders are already planning necessary extensions. Those who build at once and are ready for the demand will get the greatest benefits. Building costs are lower in winter than in the rush season and there are no delays.

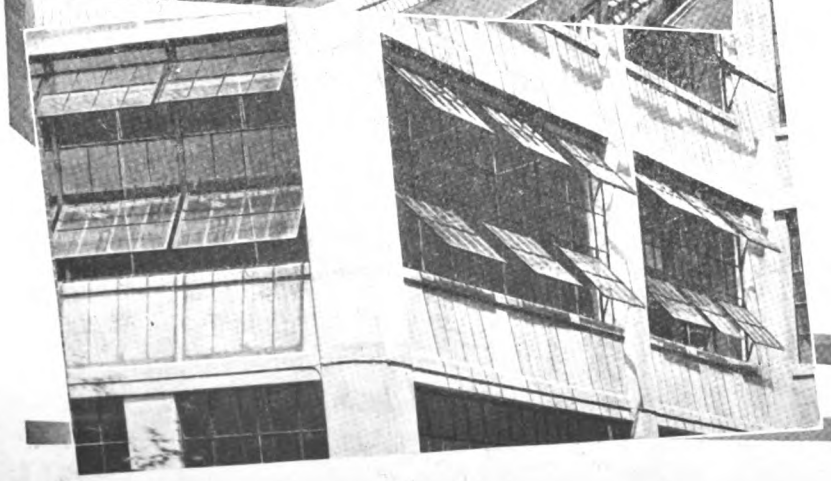
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On page 82 will be found a list of those concerns to whose courtesy we are indebted for photographs in this issue not otherwise credited.

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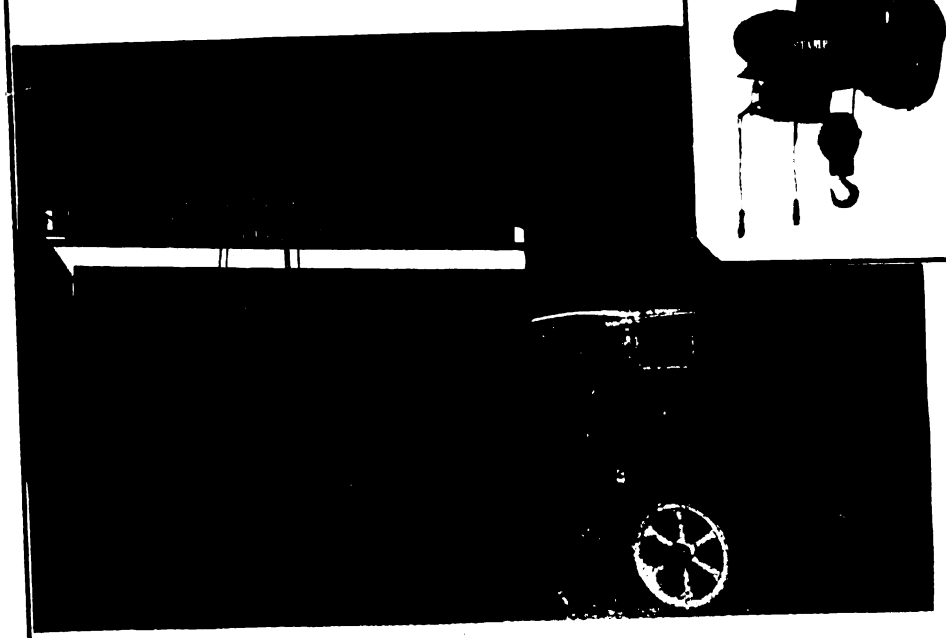
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In Dust—Grit—and Acid Fumes



This Hyatt equipped Stamp hoist, used by a chemical plant, to and from a dipping vat, is constantly enveloped in acid fumes.



A one-ton Stamp hoist manufactured by the Stamp Electric Hoist Company, Cleveland, Ohio, embodying seven Hyatt bearings.

A Stamp hoist, equipped with Hyatt roller bearings, handling loads of brick from kiln to truck. Continually covered with brick dust and grit.

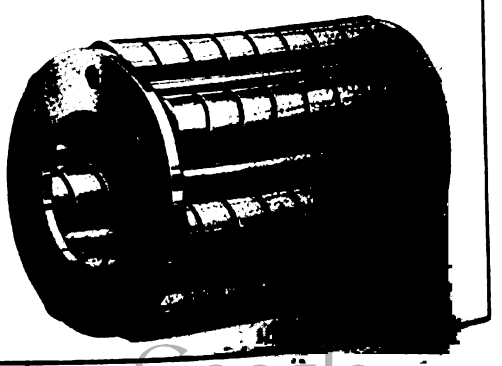
The efficient operation of Hyatt equipped cranes, trolleys and hoists is not hampered by the unfavorable conditions under which they work. These machines are fortified against any damage from the dirt and grit that settles on them.

The sturdy construction of Hyatt bearings enables them to withstand overloading and severe emergency duty. Even abuse and neglect at the hands of unskilled labor fail to cause any trouble. These bearings give smooth, uninterrupted service, year in and year out, without adjustment or replacement.

Even in the presence of acid fumes the efficient operation of Hyatt equipped handling machinery is not retarded. The distinctive features of the bearing housing and of the roller bearing itself insure complete and continuous lubrication. And it is only necessary to oil once every three or four months.

Hyatt equipped machines save operating power and labor, and speed up the work. The crane shown above as used in a chemical plant is operated through the entire working day by one girl, eliminating additional labor formerly required for the same work. The ease with which these machines may be moved and controlled makes them well adapted to use by girls.

Whatever the conditions under which your trolley, crane and hoist must operate, you will find that a Hyatt equipped installation will handle larger tonnage at lower costs.



Hyatt Roller Bearing Company

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No. 1—Where 8 men used to take a day and a half to unload a car at a plant at Newton, Pa., 2 men and a Barber-Greene now do it in 2 hours.



No. 2—Barber-Greene used for storing coal and slag in the plant of the Union Switch and Signal Company at Swissvale, Pa.

No. 3—Showing the conditions under which the Barber-Greene shown in No. 2 handles slag.



No. 4—A Barber-Greene unloading castings at Cleveland Tractor Company's plant.



No. 5—The same Barber-Greene shown in No. 4 handling coal.



No. 6—A battery of Barber-Greenes handling coal to storage in a large Massachusetts power plant.



Cutting down the P. O. U. price of materials

The vigorous current attack on the price of coal and other bulk materials in many industries is emphasizing more and more the importance of the P. O. U. price.

The old F. O. B. way of figuring leaves out of consideration what you can do in your own plant to bring down the price of the materials you use.

The P. O. U. price—the price at point of use—takes handling cost into consideration and figures the cost of coal at the boiler door instead of at the mine or on the switch track.

The P. O. U. price is the real price, and in many cases can be reduced much more easily than the F. O. B. price.

The Barber-Greene development of standard portable material handling equipment is due entirely to the attention all industries are paying to the P. O. U. price.

In many cases it has reduced the price of coal at the boiler from 10 to 50 cents per ton.

In a large number of plants the same Barber-Greenes that save 90 man hours in unloading a car of coal, stone, sand, or the like are also used for loading, unloading and transferring other materials.

If the coal situation is interesting you particularly right now because of the possibility of mining troubles in spring or before, send for our coal handling catalog.

If you are interested in materials other than coal as well, write for literature describing the use of Barber-Greenes in handling the materials in which you are interested. Barber-Greenes are sold at prices as low as $350—the base price of the U-Type Barber-Greene.

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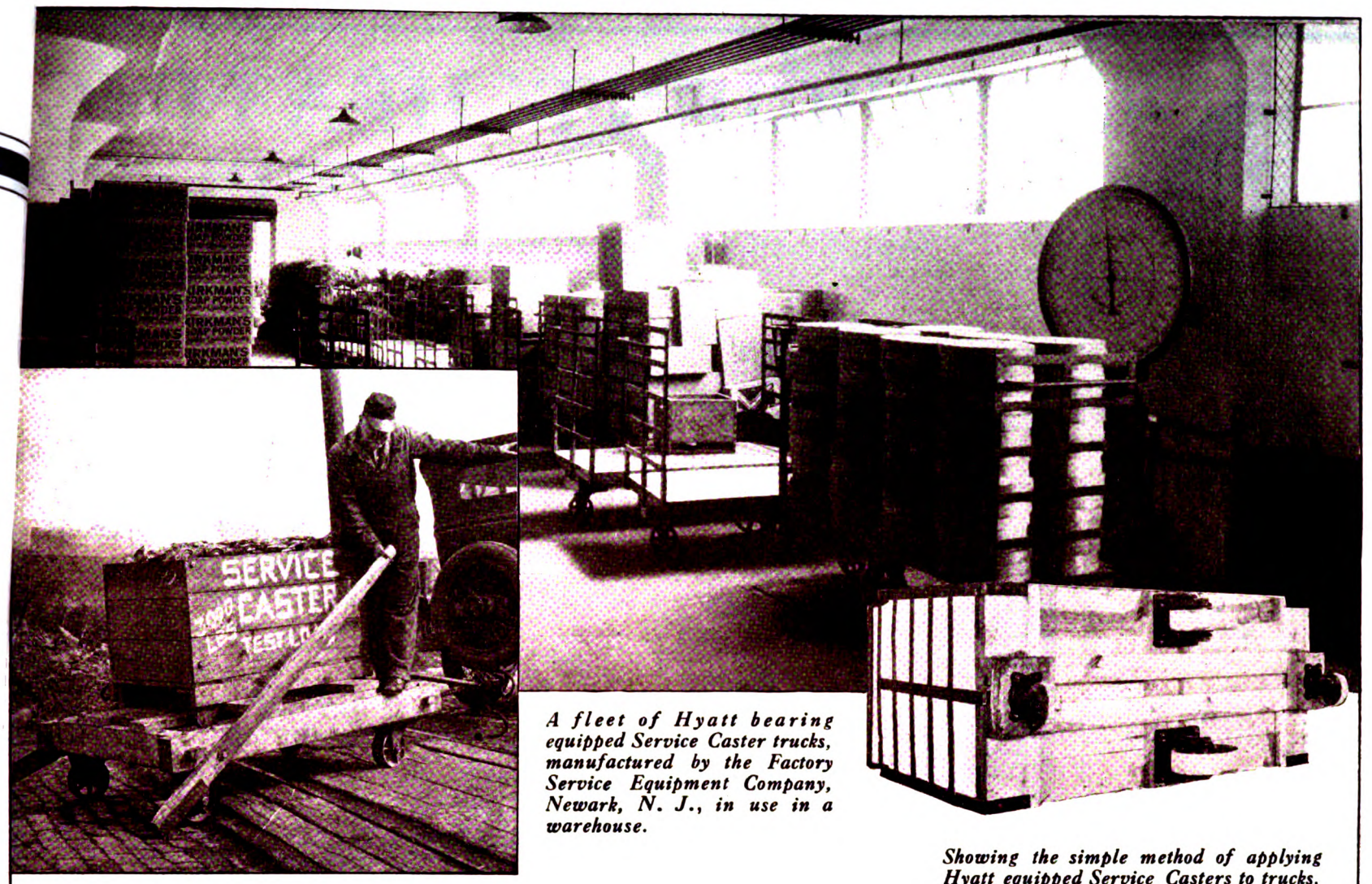
We will be pleased to have you write. Our purpose is to advise conscientiously without obligating you. Then to serve you in a practical and economical way, or if we cannot to tell you who can.

Booklet S1 will show you among others the types of equipment used by the above company in earning 169.6% per year.

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A fleet of Hyatt bearing equipped Service Caster trucks, manufactured by the Factory Service Equipment Company, Newark, N. J., in use in a warehouse.

Showing the simple method of applying Hyatt equipped Service Casters to trucks.

Test of a Hyatt equipped Service Caster truck under 3,000 lb. load over poor city streets. Rough treatment caused no breaks or noticeable wear.

Modern Warehouses and Factories Should Use Modern Trucks

The severe requirements placed on trucks by present day handling methods are fully met by service Casters equipped with Hyatt roller bearings.

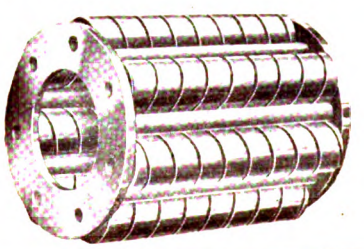
The sturdy construction of Hyatt bearings enables these already strong casters to stand up under overloading and the shocks of bumping on and off elevators, and over door sills and uneven loading platforms.

Oiling is necessary only three or four times a year. These hollow, oil retaining bearings save oil and lubricating labor.

Labor and power saving is accomplished by the easy rolling motion of the Hyatt bearings. In the warehouse shown above one man pushes the truck and makes up the job lot orders.

By specifying that your trucks, trailers and other handling machinery be equipped with Hyatt roller bearings you can speed up the work and reduce labor and maintenance costs.

Complete information will be furnished on request.



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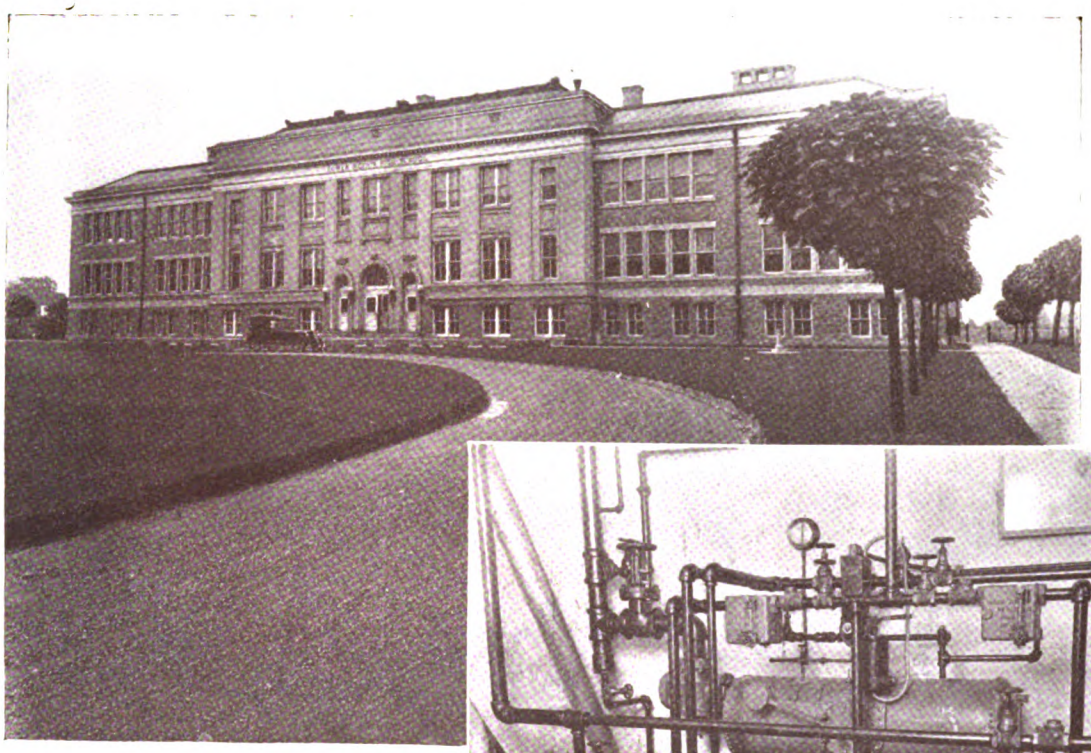
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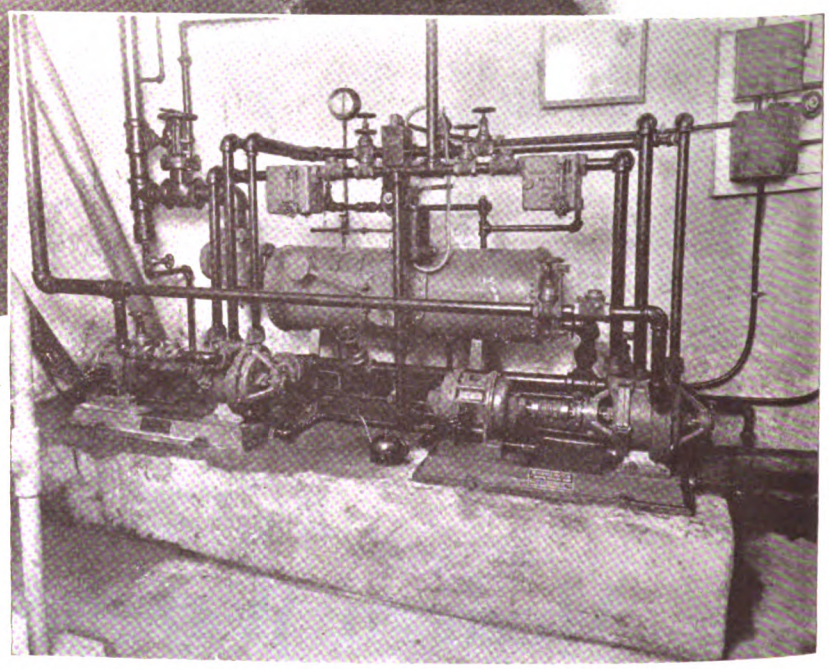
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Industry Illustrated

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Art Director

EDITORIAL

Which Road?

IT is not very long since we had in this country an orgy of "Trust-busting." Certain corporations had, by consolidation, built up such power in their own fields as virtually to monopolize these fields. Some among them had abused that power shamefully. This abuse brought about a popular reaction based upon false logic: that, since these oppressive monopolies were big, therefore big combinations of industrial organizations were inevitably bad. Instead of untying the knot, and preserving the useful cord, we hacked it with an axe. Instead of attempting to preserve the benefits due to coördination, at the same time exercising such supervision as would prevent abuses, we passed laws to make such combinations illegal.

Through observation of the trend *toward* monopolies in other countries, and through experience with our own efforts to *prevent* monopolies, it may be that we have learned to discriminate between the just and the unjust, the harmful and the beneficent "Trust." Yet we do not seem to have solved the problem, and it is still a common thing for the professional politician to build up a following merely by attacking "The Corporations."

The unparalleled growth of radio broadcasting during the past two years, for example, has created an immense market for the vacuum tubes used in radio reception. The patents under which these tubes are manufactured are controlled by The Radio Corporation of America, a combination which embraces, among others, such well-known organizations as the Westinghouse Electric Manufacturing Company, the Western Electric Company (a subsidiary of the American Telephone and Telegraph Company) and the General Electric Company.

There is no doubt that, in the understanding of the "muck-rakers" of a decade or two ago, the Radio Corporation constitutes a "Trust." There is no doubt that this corporation and its component companies are in a position to monopolize radio broadcasting, and there is a well defined impression that the profit margin on vacuum tubes is high.

On the other hand, the Western Electric Company, the American Telephone and Telegraph Company, the General Electric Company—are constantly engaged in research work of first importance. Such achievements as the broadcasting over the entire country of Mr. Wilson's Armistice Day speech, of President Coolidge's Message to Congress, are epochal; they are a distinct and vitally important contribution to knowledge and to social progress. Such an achievement as the recently announced mercury boiler, with its promise of doubled power efficiency, is not incidental; it is revolutionary, and of incalculable benefit to all mankind. But these achievements are the product of research, and research of this kind is expensive.

We need to discriminate, to appraise, to *think* —before we rush into a characteristic popular brainstorm of reform agitation.

Should we legislate all big combinations out of existence merely because they are big, and because some of them possess the power to do harm? No doubt the price of telephone service or of vacuum tubes could be lowered—but this would mean only small savings to a relatively small proportion of people.

Is it wiser to abolish all monopolies and to restrict profits to a predetermined percentage, or is it wiser to foster benevolent monopolies and combinations and to permit large profits for the sake of the progressive research which these profits make possible?

There is occasion for thought on this problem. It is one which has furnished perennial ammunition for the political spellbinder. The reception accorded to Secretary Mellon's clear, concise analysis of the tax reduction program and the soldier bonus, however, indicates that popular opinion is at the mercy of the spellbinder only so long as there is no leader capable of presenting a logical, well reasoned array of *facts*.

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Planning the

The Part that Building Design

By George C.

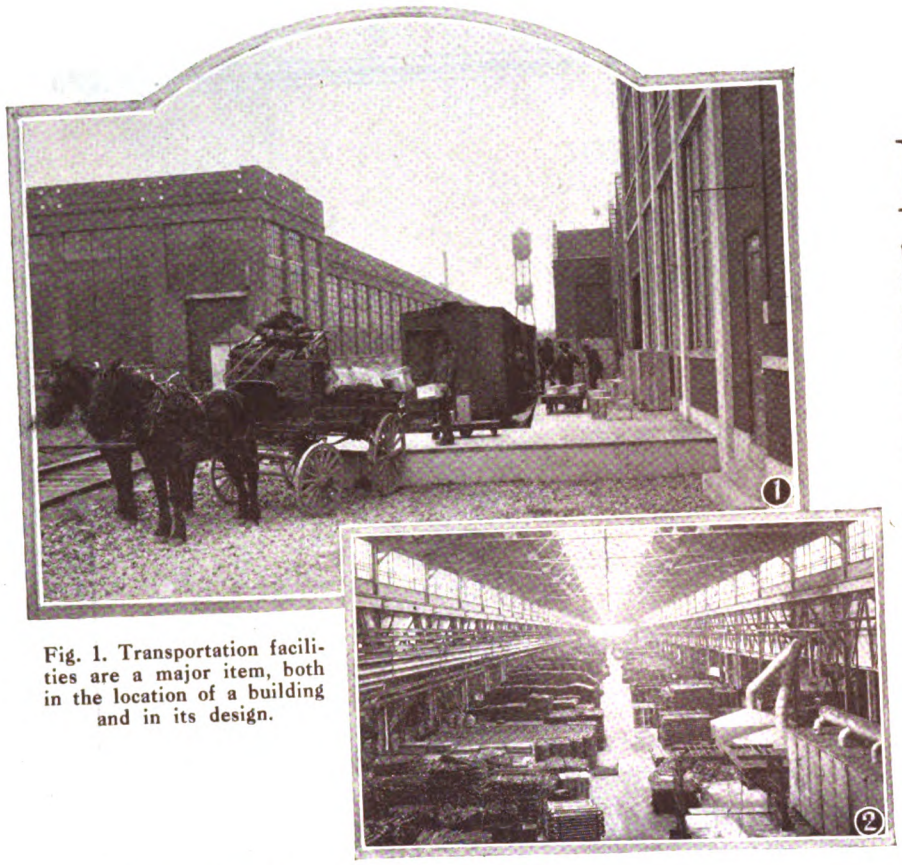


Fig. 1. Transportation facilities are a major item, both in the location of a building and in its design.

Fig. 2. It was the demand for unobstructed wide areas, which led to the design of structure now so often encountered in the case of storage warehouses outside the congested districts.

Fig. 3. With plenty of ground, the single-story, saw-tooth roof offers good natural light and ventilation, at comparatively low cost if the process does not demand much overhead room.



Fig. 4. Here, with much greater headroom than in Fig. 3, we still have maximum daylight and ventilation provided for in the design.



Fig. 5. In certain manufacturing processes, upright columns are useful; in others, they are to be tolerated only as a necessary evil. These factors should be considered in advance.

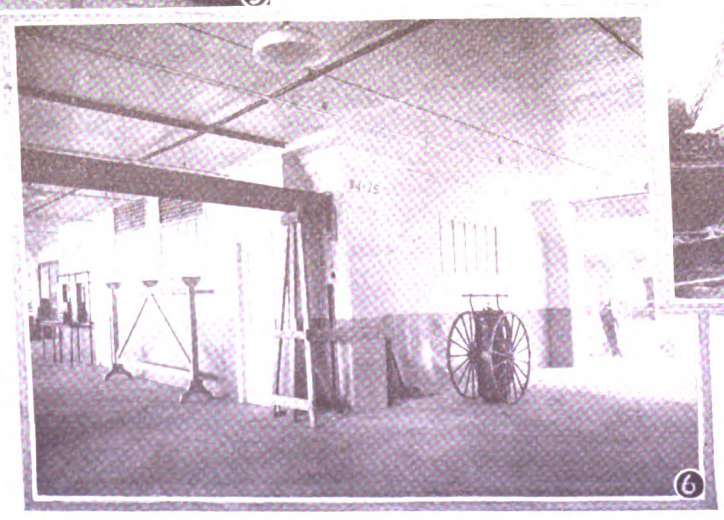


Fig. 6. Fire prevention (and lower insurance rates) is not a result of afterthought, but should be made a part of the plan of the building itself.



Fig. 7. Every column and girder, every truss, every rivet-hole, has to be planned for in the design; and the "anatomy" of the structure determines whether it shall be an asset or a profit-consuming liability.

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In the growth and development of mankind, one of the most interesting features is the fact that mechanical inventive ability did not appear to any material extent in the make-up of human character till our own modern times. After Adam and Eve moved out of the Garden of Eden and started the three basic industries of providing food, clothing and shelter, there never was a time during all the thousands of years which followed when man showed to any comparable extent that mechanical inventive ability which is now and has been during our own times a general characteristic of the people of Europe and America. Why this ability to invent machines and harness the forces of nature to do the hard work should have been held back during all these years and then suddenly develop among the people of our own times is one of the mysteries of the growth and development of mankind.

No doubt each age in the scheme of creation has its part to play and there seems to be no question but that the part which our people were intended to take is, in the main, the development of science and mechanical inventions. The only question which arises sometimes as to how well we have served humanity in applying this wonderful inventive genius is whether or not we have played fair with posterity by

New Building

Plays in Modern Production

NIMMONS, F. A. I. A.

using up more than our share of the resources of the earth. By the use of our powerful machines and our extraordinary means of transportation, we act as if we owned the earth and that its supplies were only for us, as we are stripping it of some of its essential raw materials at a most alarming rate. What the future generations are going to do for fuel, minerals and building material is a problem. Let us hope that our wonderful inventive genius will continue on in the race and solve their problems just as it has solved ours. The least that the people of our time can do in the meantime, as a small recompense for this apparently selfish consumption of the resources of the earth, is to hasten the enactment of proper laws for reforestation and for the conservation and prevention of the waste of many of the other essential resources.

The invention in rapid succession of the steam engine, the loom and a host of other industrial machines was the cause of the beginning of the modern factory system. Home industries, such as weaving, shoe making, furniture making, etc., gave way to the factory product.

The history of the factory re-

(*Continued on page* 41)



Fig. 8. Locating the site with due regard to land values, transportation facilities, nearness to markets, and character of buildings required—this alone is a major problem.

Fig. 9. A warehouse is usually considered strictly in the light of its utility; but this illustration of a thoroughly practical Brooklyn, N. Y., warehouse, proves that there is no need to make it a blot on the landscape.

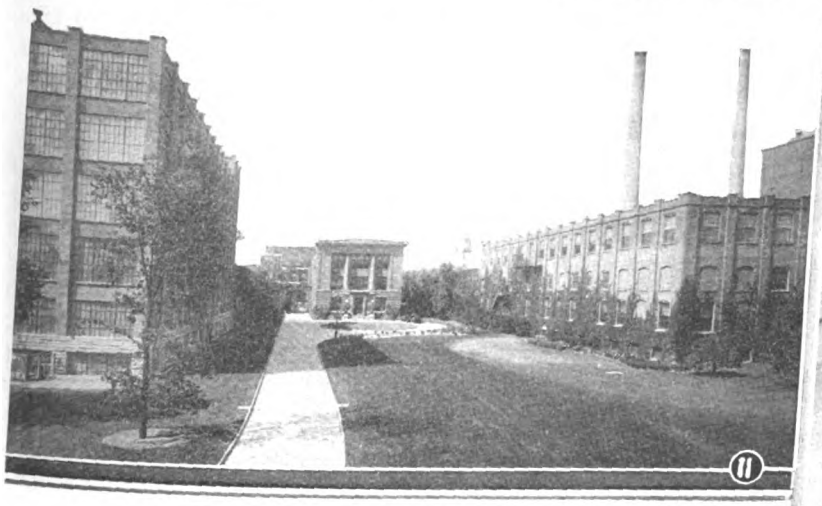


Fig. 11. The difference in cost between an ugly, box-like structure, and one of architectural beauty, is such a small percentage of the total as to make the latter well worth while.

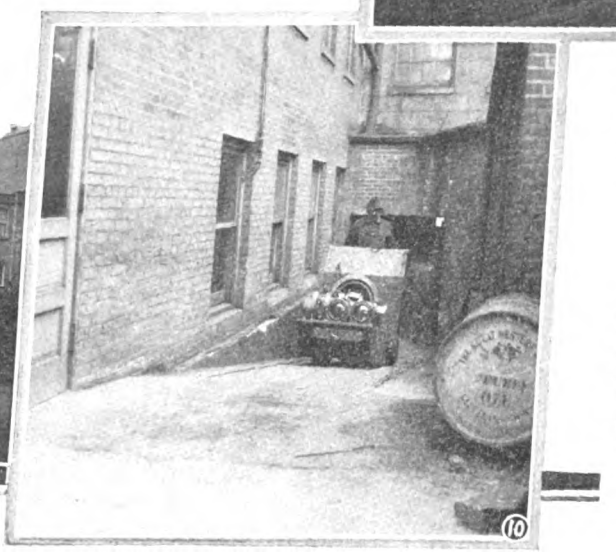


Fig. 10. Inter-factory and intra-factory transportation should be considered in the original plan, as many executives have learned to their cost, in this modern day of materials handling science.



Fig. 14. One of the newer factors which has had to be taken into consideration: parking-space for the employees' cars.

Fig. 13. Below is another case where the owners realized that architectural beauty pays, in increased good will and in better morale, to an extent far outweighing the slight extra cost.

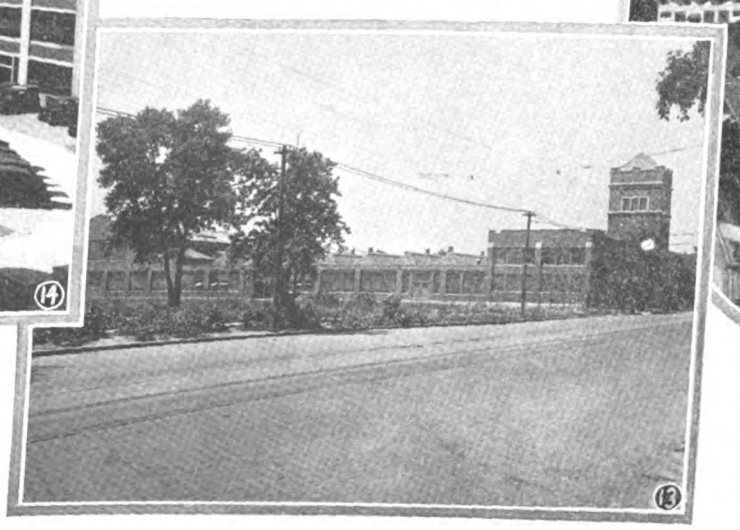




Fig. 12. It may make all the difference between profit and loss, to have the individual buildings of a plant so arranged as to make for straight-line production—with future additions already planned and fitted into the major plan.

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What Paint Means to Maintenance

Protection, Appearance, Identification and Illumination—All Depend Upon Paint

By William G. Ziegler



Fig. 1. A department can be transformed almost overnight by putting a well-organized force on the painting job. The results will be immediate in increased production and comfort.

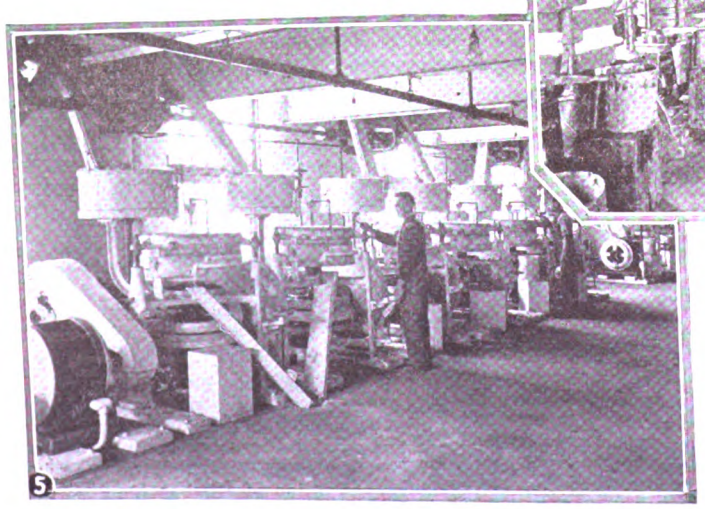


Fig. 2. Wide bays and low ceilings add to the complexity of the lighting problem. Proper painting, as in the textile plant below, helps to solve this problem and to save many dollars worth of electricity.

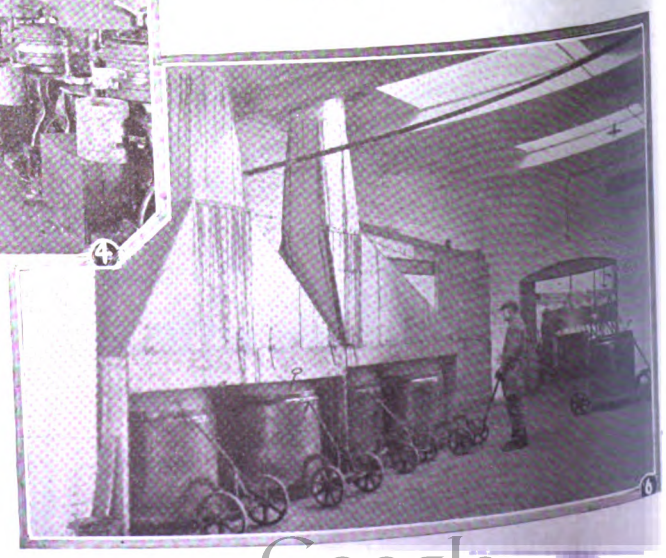


Fig. 3. Not only is the daylight effect of properly painted ceilings a distinct source of economy in making the most of light which comes through the windows, but in addition it tremendously multiplies the effectiveness of artificial lighting.





Figs. 4, 5, and 6. The production of modern paint is a highly technical process combining scientific research and discovery in chemistry, physics and mechanical engineering. These three pictures give an idea of the mechanical equipment of some of the departments in a modern paint-making plant.

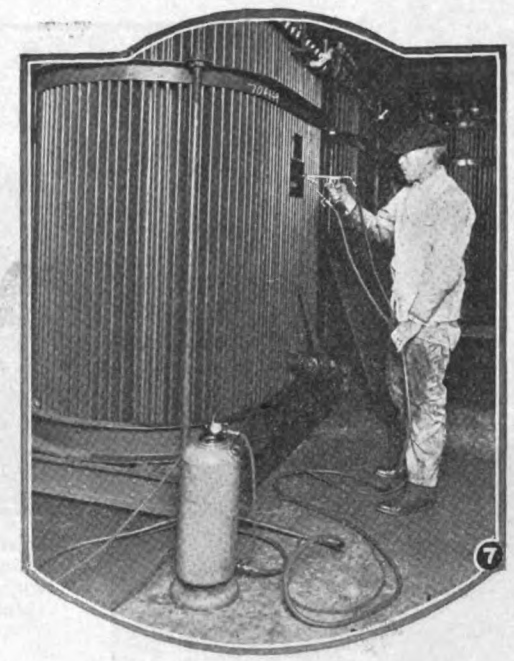


TIME and money spent on painting the plant and its equipment will pay dividends in keeping the plant fit, and thereby enable it to go on year after year earning a profit for the owner. For let it be remembered that a plant depreciates rapidly unless a regular and systematic effort is made to slow up or eliminate deterioration. A small amount spent each year on painting the plant and its equipment is an excellent investment, and in the long run it will be found to be much cheaper than neglecting to take care of things. Sooner or later this course will necessitate replacing things at a large cost. As in other maintenance work the use of high grade materials for all painting will be most economical. Painting does not add to the value of the plant, if it is assumed that the plant has always been in good condition, but it tends to keep the plant at the same value each year by slowing up depreciation. However, most accounting departments consider painting as a repair and not as a betterment. In the case of alterations or extensions which are considered as betterments, the painting will naturally be a part of the job and considered a betterment. This painting should be done as soon as the job is finished. Unfinished surfaces look badly and tend to lower morale.

Properly painted factories reduce the cost of lighting due to

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7. The atomizer principle has
e it possible to effectively use
instead of hair" in applying
it to various surfaces. The ad-
tages are particularly apparent
re these surfaces are recessed or
gular and difficult to get at with
a brush.



t that the white ceilings
alls reflect all the light
nto the work. Proper
g also speeds up produc-
because with good light
will be less eye-strain and
oilage, and the men will
e to accomplish more. A
t improvement in the
of the product will usu-
llow any improvement in
inting of walls and ceil-
and a reduction in the
r of accidents will usu-
llow.

permanent jobs the so-
oil paints should invari-
be used, as they have
r reflecting capacity and
permanent. Cold water
s and whitewashes are
used on jobs of a semi-
anent nature or in base-
s or other such places
e the object is to make the
ce white at the lowest cost.
water paints have good
g power, and they are
p, but they are not to be
mmended where a perma-
finish is desired. They
ld not be used on concrete
aces where high humidity
ts, as they may mildew and
large surfaces.

n connection with applying
of the so-called prepared oil
nts, it should be remembered
to get the best results, thor-
h stirring is necessary. The
ment must be thoroughly

Fig. 8. Fire risk is reduced and an impetus to cleanliness provided where heavy timbers or transmission framing is made smooth and white by proper painting. Liability to accident in places such as this is also materially reduced through the better lighting secured.



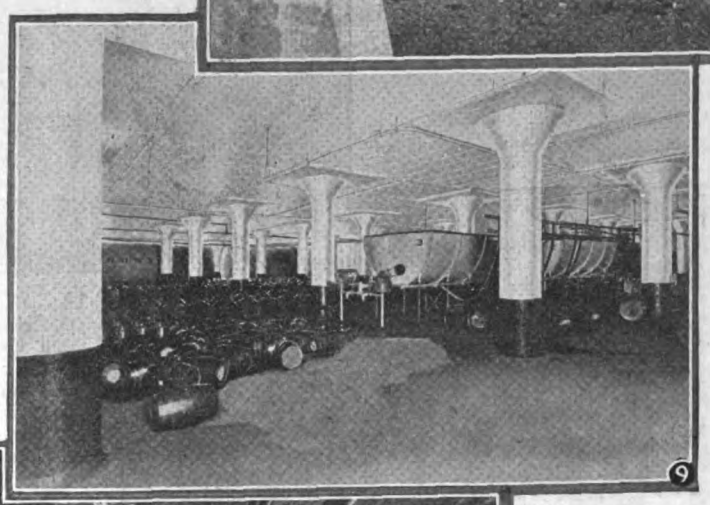


Fig. 9. Cleanliness is as desirable in industry as at home and nowhere more so than where food products or beverages are made. Note the spic and span effect of this storage department in one of the Coco Cola bottling plants.

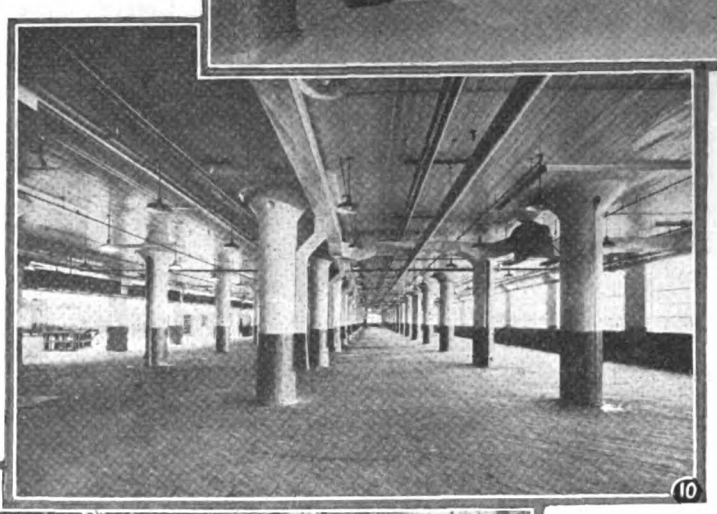
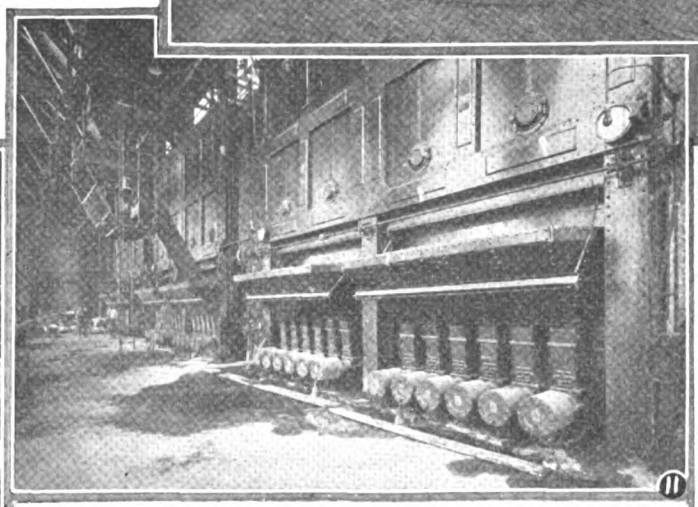


Fig. 10. Modern industrial plants contain thousands of feet and often miles of air, steam, gas, sprinkler, city water and other pipes. When the emergency comes the repair man knows exactly what he is doing if the pipes are distinguished according to service by suitable colors.

Fig. 13. Portable air compressing units for use in paint spraying are available and particularly useful in plants or departments not served by stationary air compressors. Below is shown an outfit of this sort in use.



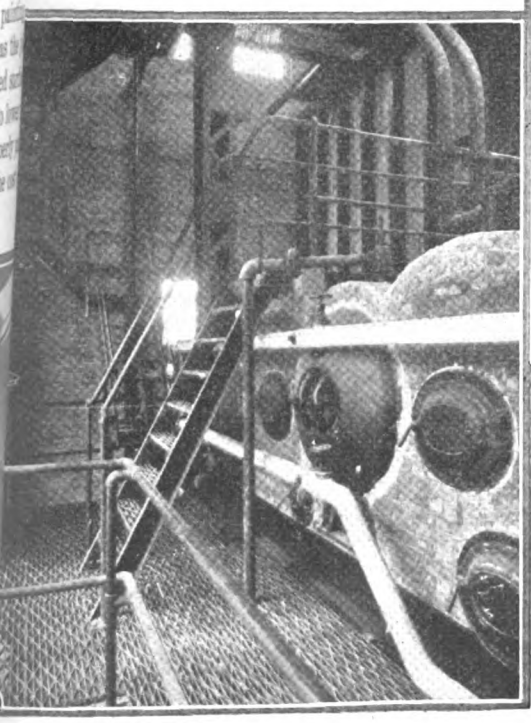
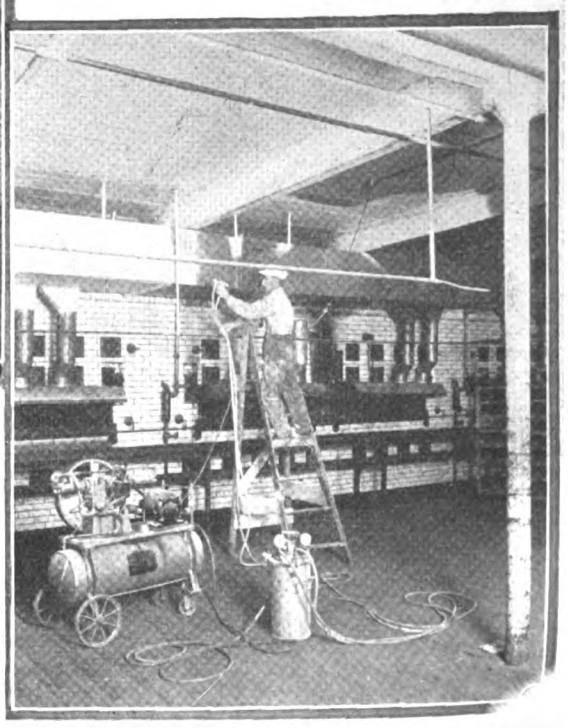


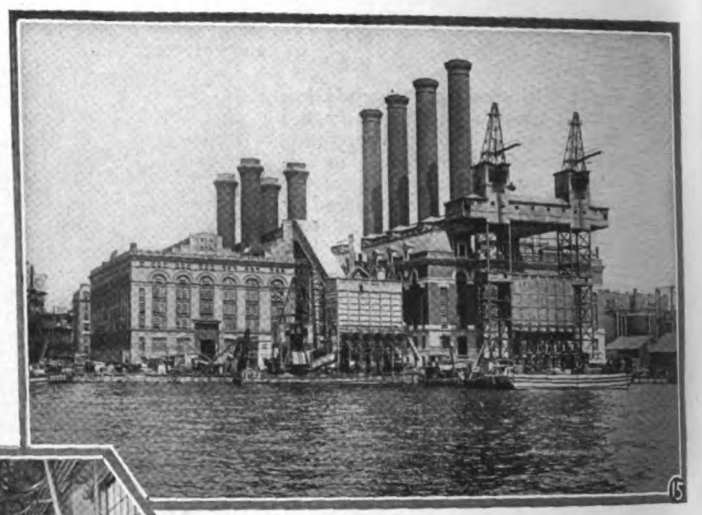
Fig. 11. So far as painting is concerned perhaps the most neglected part of the average plant is the boiler room. The proper painting of boiler fronts, steel work, steam and water piping and concrete floors, is a distinct aid in maintenance and in reducing depreciation.

Fig. 12. In the power house of the Cadillac Motor Car Company, of Detroit, attention is given to proper painting which includes a definite color scheme for identification of various pipe lines.



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Figs. 14 and 15. The industrial painting problem is not confined to the interior of the buildings. Exteriors must be protected from rain, snow, dampness and moisture, which produce decay and depreciation in expensive structures. Here are two examples of attention to exterior maintenance through proper painting.



Fig. 16. Precision work under the best conditions taxes the eyesight and requires good vision. It is handicapped in many plants by permitting the light from the windows to be absorbed by dingy walls and ceilings. Not so in this machine department, however, where proper painting is considered a necessary part of production.



Fig. 17. One can tell from looking at this picture that the plant represented is in capable managerial hands. Most store or stock rooms are neglected so far as paint and light are concerned, but not this one.

mixed with the liquid so that the paint will be the same consistency throughout the job. If not properly mixed the paint will be too thin at the start of the job and will probably run, and will not hide the surface. The best way to stir is to have an empty can or tub half the size of the one being opened. Dip out or pour off most all the liquid into the empty vessel. Then with a good broad paddle stir the thick portion in the original container until it is of a uniform consistency. Then gradually pour back the liquid, stirring each batch into the pigment before another is added. In this way the paint will be thoroughly mixed and will give the best results.

The light reflecting capacities of various kinds and colors of

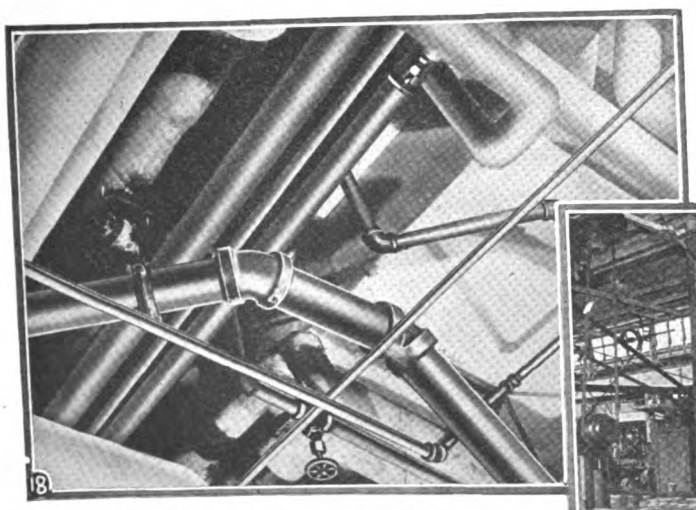
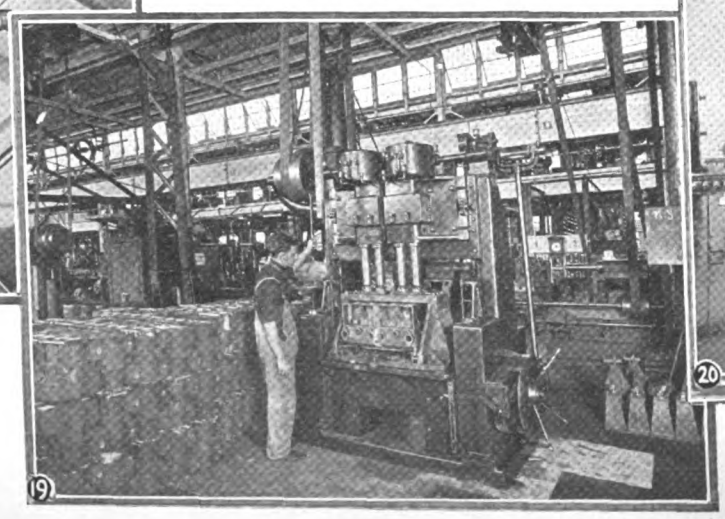


Fig. 18. This is a puzzle picture in black and white, the problem being to tell which pipes are "which"—oil, gas, air, steam or water. Actually, however, it is not difficult, for each one has its own distinct color which proclaims its purpose without hesitation or uncertainty.

Fig. 19. The average man takes pride in the spic and span appearance of his automobile. This same spirit applied to the machine tools in a factory indicate that the manager takes pride in his equipment. Painting machinery and keeping it spic and span has a distinct effect on the operator too.



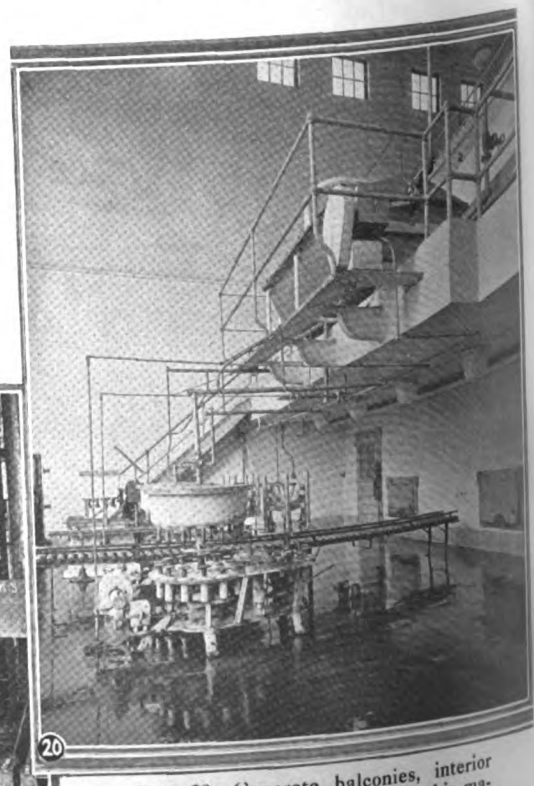


Fig. 20. Concrete balconies, interior walls and other structures of this material, when properly painted, not only reduce the cost of lighting and make a most attractive appearance, but will undergo less wear and tear.

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Fig. 21. Good light and cleanliness add to the efficiency of producing printed matter. Many print shops are horrible examples of poor painting and dirty windows. Not so in this picture which shows a department in the Henderson Lithographing Company, of Cincinnati.



Figs. 23 and 24. Just what painting will do in the way of increasing lighting effect is well illustrated in these two pictures which show two departments in the plant of the Cleveland Crane and Engineering Company. (Compare this with Fig. 24 below at the right.)

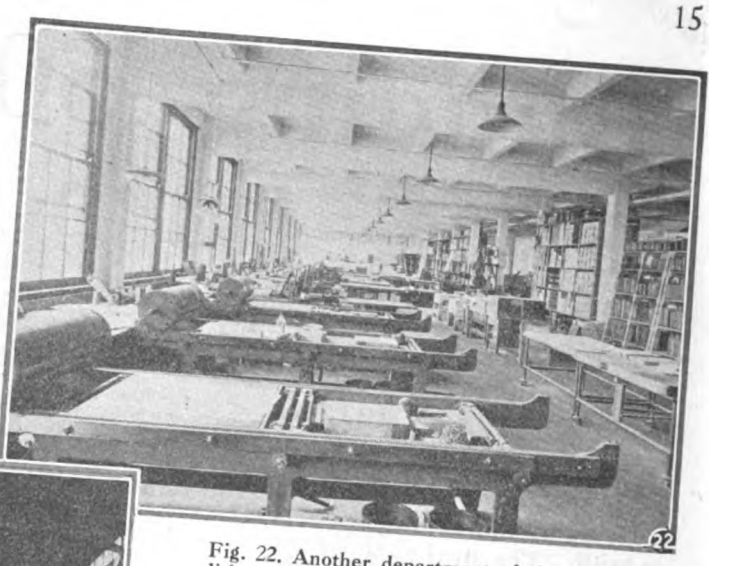


Fig. 22. Another department of the same lithographing establishment is shown here. Note how the daylight through proper painting penetrates clear back to the stock racks at the right.

paints have been carefully measured and charted. Mr. H. A. Gardner, of the Institute of Industrial Research at Washington, has made extensive tests on the reflective capacity of many kinds and colors of paint. It was found that on a basis of .98 for the coefficient of reflection for a block of white magnesium carbonate that the commercial white industrial paints for inside use have coefficients of reflection ranging from .74 to .82. These figures are very high compared with similar kinds of paint sold several years ago. It is evident that the increase in the reflecting value of the modern industrial white paints has been the result of years of research.

The cost of artificial lighting is inseparably tied up with the light reflecting values of the walls and ceilings, and it is evident that the cost of lighting can be reduced by keeping walls and ceilings well painted with white paints which preferably can be washed down. The shallow bowl reflectors used on the large general lighting units in the factory allow a large percentage of the light to travel in a horizontal direction. This light is reflected and diffused when it hits the nearest wall or column, and in that way influences the illumination besides making the room appear larger and more cheerful. Executives are coming to recognize that cheerful surroundings tend to make the employees contented and in time should tend to increase both the amount of the product delivered and also better its quality. White paint on ceilings and walls is probably the most important factor in solving any problem of lighting. Surely it will be admitted that without white paint as a contributing factor any artificial lighting problem will be harder to solve. Where indirect lighting with opaque bowls is used, a white ceiling to reflect and diffuse the light is absolutely essential.

There are several other qualifications which a paint should have in order to be of maximum service in interior plant painting. We all think first of light reflecting capacity as a major qualification and it is well that we do so. However, there are

(*Continued on page* 32)



Fig. 26. Good maintenance management requires that a department be well painted, not only when it is new but that it be kept well painted as long as it is in use. Here is a good example of modern painting practice.

Fig. 25. Ordinarily roof trusses of this sort made of heavy timber help to produce a dark shop because of light obstructing qualities. These are offset, however, by proper paint, as is evidenced by this interior of the Canton Bridge Company.



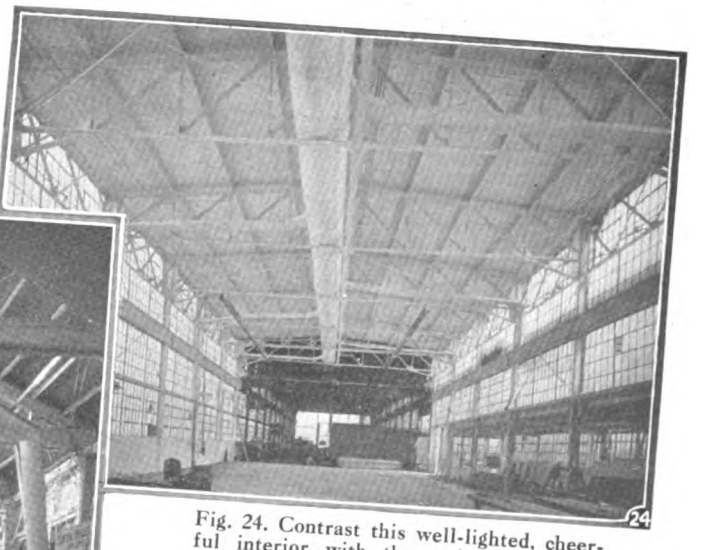


Fig. 24. Contrast this well-lighted, cheerful interior with the rather forbidding aspect shown above (Fig. 23)—solely a matter of intelligent application of paint.

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Building 50,000-Horsepower Turbo-Generators

A Plant Whose Products Dwarf the Men Who Make Them

By John H. Van Deventer

At Schenectady a ten thousand horsepower turbine-generator set is the smallest built. The smaller units are built at the Erie, Penn., plant. In the three great buildings at Schenectady devoted to this work, more than a thousand men are continuously employed in machining parts, and erecting and testing sets ranging in size from ten thousand to eighty thousand horsepower—this latter being the largest yet built. Turbines of fifty thousand horsepower rating are comparatively common in these works.

Measured in gross volume of sales per annum, turbine-generator sets form the chief product of the General Electric Company's Schenectady Works. The growing average size of the individual units and the magnitude of the business as a total, are striking proofs of the rapid development we are now experiencing with regard to the increased generation of power and its utilization.

Advanced engineering and skilled production are the two big *internal* factors in the development of the modern large capacity turbine-generator. The ever increasing demand for more power on the part of the industrial world and the private citizen is the big *external* factor. Probably in no other line of engineering is a more diverse and highly specialized accumulation of knowledge, theory and experience required and certainly in no other kind of apparatus building are the production problems of more magnitude or more difficult to solve.

Engineering, mechanical and electrical, is called upon to exert its utmost in behalf of the modern large capacity turbine generator unit. A sharp division in this engineering work is drawn between the steam and the electrical ends of the unit, each of which requires its staff of highly trained experts.

The engineering problems of the steam end are complicated by a number of unusual condi-

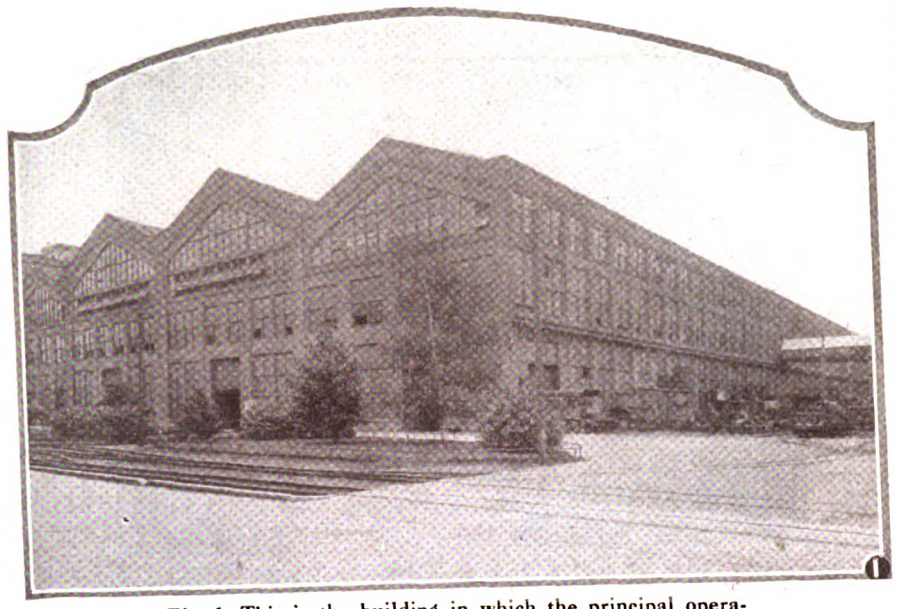


Fig. 1. This is the building in which the principal operations of machining and erecting huge turbine generators are carried out. It is known as Number 60 and is 800 feet long and 340 feet wide. It contains nearly 1,000 machine tools and 35 overhead cranes.



Fig. 2. Building 52, also 800 feet long, is parallel to building 60 and connected to it at one end by a six-story administrative building. In 52 the huge electric generators which form part of the turbine generator set are wound and assembled.

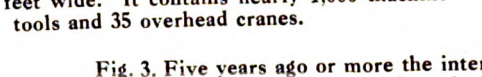
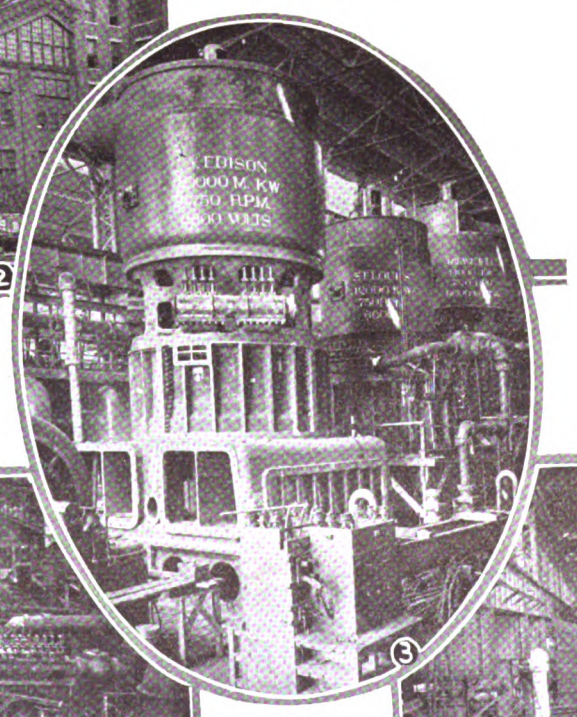


Fig. 3. Five years ago or more the interior of building 60, at the erecting floor, looked like this. In those days "vertical" turbines were the rule. A 20,000 kilowatt unit was considered a monster.



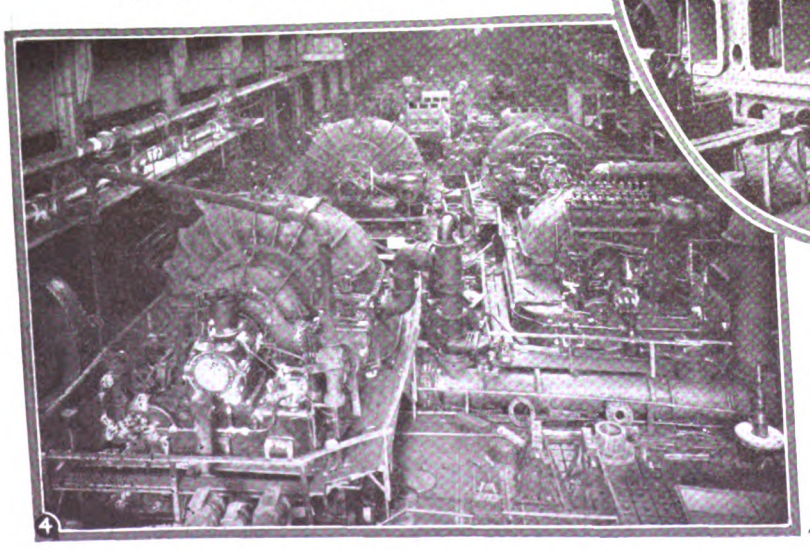


Fig. 4. Today the large units are "horizontal" and the size has enormously increased, 50,000 and 60,000 kilowatt sets being not at all uncommon. If made vertically in these sizes they would extend too far up in the air.

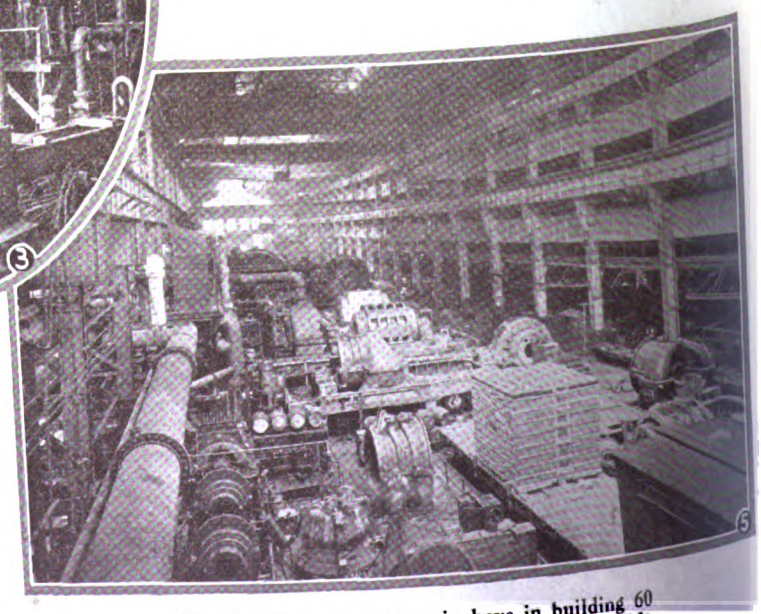


Fig. 5. There are two main bays in building 60 and three side bays, two of which have double mezzanine floors. The main bays house the huge machine tools—some of the largest in the world—and also the test floors. This is a view of the east bay from the south or shipping end.

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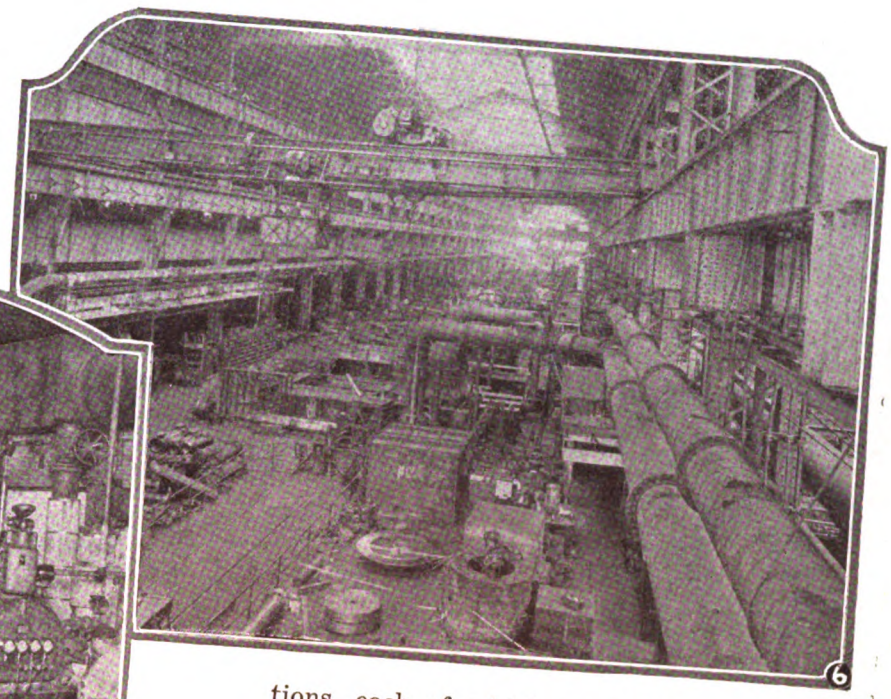


Fig. 6. A similar view of the west main bay is shown here. Standard gage railroad tracks enter both of these bays, so that the completed units have adequate crane service for loading them upon flat cars.

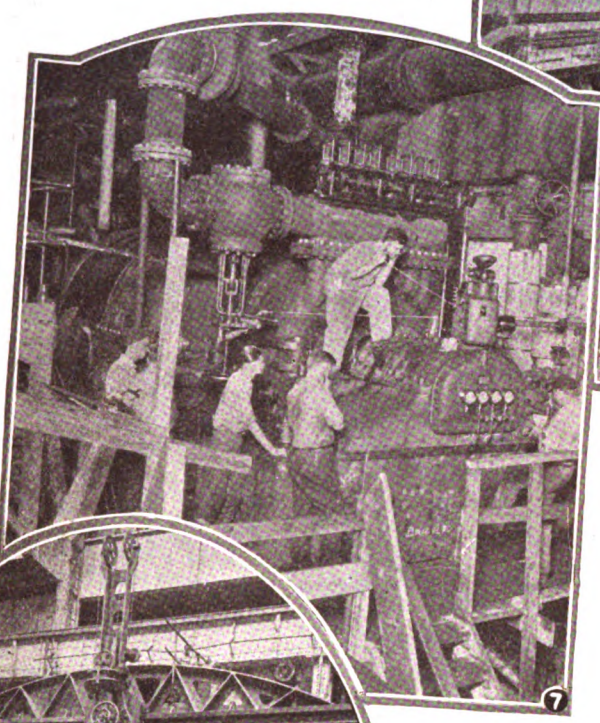


Fig. 7. Elaborate and careful tests are made of each completed unit. Young engineers are shown here testing a steam turbine and at the same time adding a store of practical knowledge to their technical education.

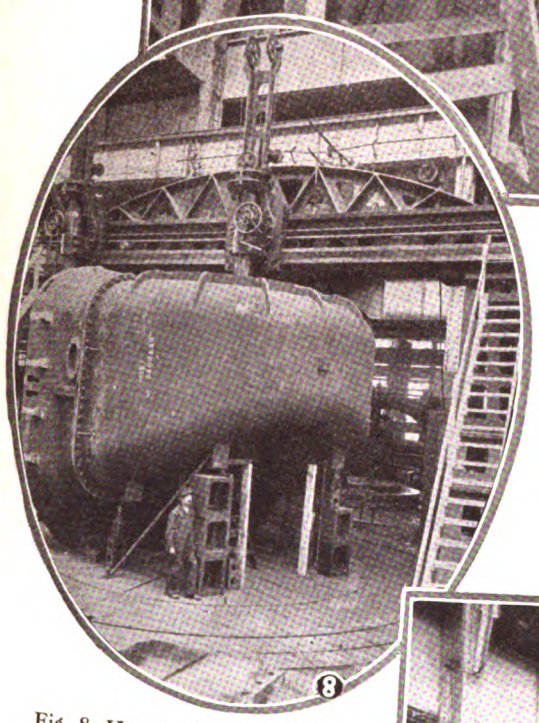


Fig. 8. Here's where machining becomes a matter of weeks and months instead of days or hours. Castings of thirty and forty tons in weight are not uncommon and present their own difficult problems in handling and setting up.

tions, each of which would be difficult individually of solution and which in combination are most perplexing. The high rotative speeds produce stresses far beyond those encountered in ordinary engineering practice. They call for the use of materials of enormous strength. They call for the most unusual precautions in the way of engineering tests, not only for strength, but for balance and vibration. They call for the detection of unseen flaws which may hide within the steel forgings used for bucket wheels, and which are detectable only by the mysterious sensibilities of the magnetic analysis machine which unerringly points to the interior blow-hole of impurity. They call for such unusual and difficult engineering feats as that required to compensate for the more rapid heating and consequent expansion of the comparatively thin bucket wheels which actually draw away from the comparatively heavy shaft on which they are mounted during periods of initial heating. They call for elaborate tests to determine whether the natural periodicity of vibration of bucket wheel discs and even of the long bucket blades of the low pressure stages, will coincide with the operating speed and hence cause vibration or chatter.

The high steam pressures, low vacuum and high superheat introduce an additional set of perplexing engineering problems. Cast iron no longer suffices for high pressure shells, and so we find huge steel castings, the sections three inches thick and with seven-inch bolting flanges, imprisoning the tremendous bottled energy of fifty

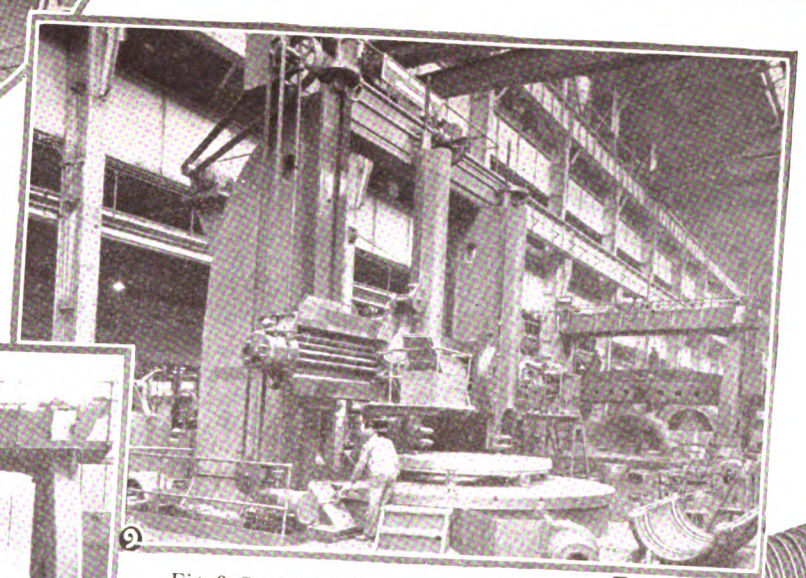


Fig. 9. Stationary diaphragms as they are called alternate with each rotating bucket wheel in the completed turbine, there being a diaphragm and a bucket wheel for each stage and from thirteen to twenty-three of each on one turbine. Above is a diaphragm on a big boring mill.

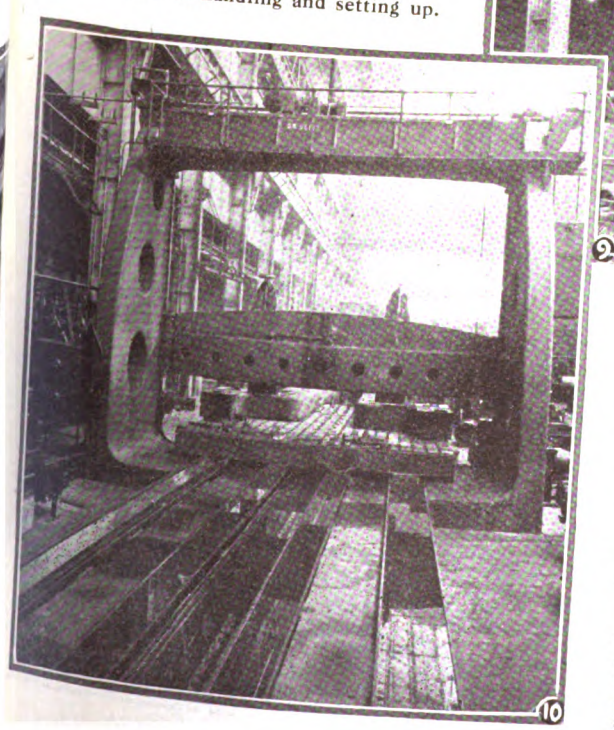


Fig. 10. The largest planer in the world in the west bay in Number 60 is kept busy planing base plates, flange joints on turbine shells, and other enormous castings. The mirror-like reflections on the ways indicate the degree of attention to lubrication.

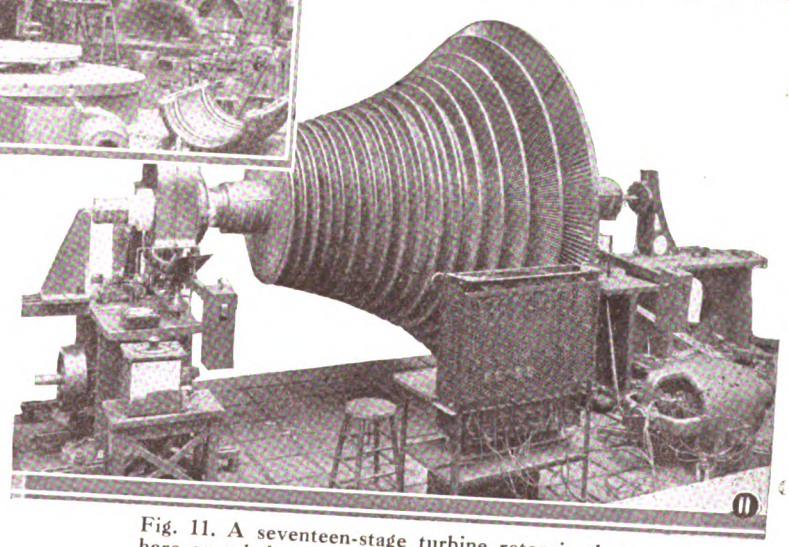


Fig. 11. A seventeen-stage turbine rotor is shown here on a balancing machine ready to receive both running and static balance. In addition each of the seventeen wheels is tested for its period of vibration both before it is mounted on the shaft and afterwards.

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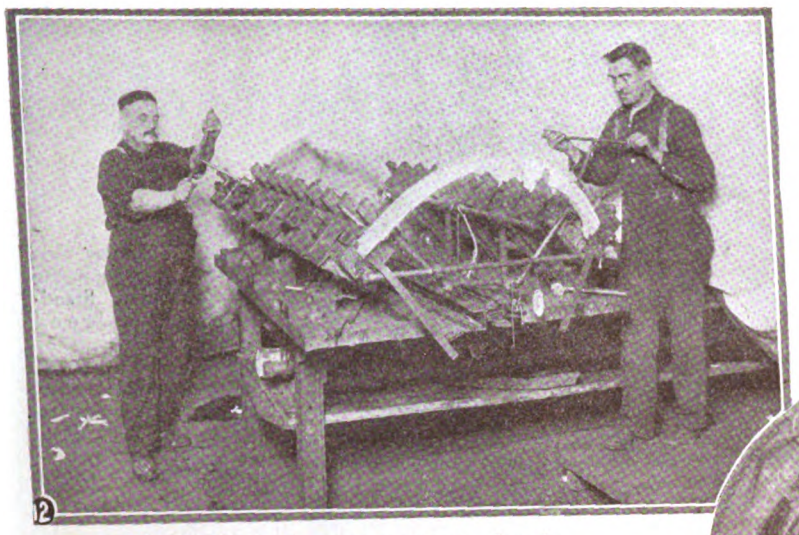


Fig. 12. Each stator coil must be hand made, wound, impregnated and baked. The use of high voltages—13,800—is common practice today and has made insulation a matter of prime importance. This picture shows a turbine generator static coil in a steam mold.



Fig. 14. Insulating compounds have been developed by special research and are made in a separate department devoted to this purpose. A portion of this department is shown above with batches of compound being made ready for use in the huge coil impregnating receptacles.

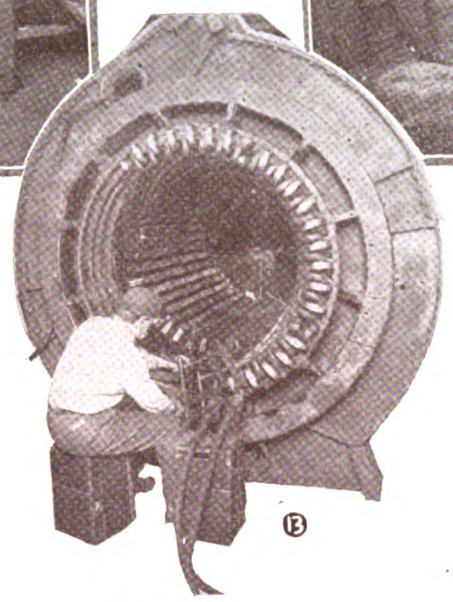


Fig. 13. The electrical half of a turbine generator unit presents as many difficulties in its engineering and production as does the steam half, but of a different kind. This is the stator of a high speed generator in which the coils are being heated and assembled.

thousand horsepower. Infinitesimal percentage savings in steam economy per horsepower, when measured in totals of annual horsepower hours, spell large totals of expenditures saved in coal, hence bucket or blade design becomes a matter of critical importance to operating economy.

In the electrical end the engineering problems are similarly complex and equally difficult. Generation of current at 13,800 volts as contrasted with the old 110 or 220 standards, has made insulation a problem only to be solved by research into the realm of new materials and compounds. Tons of copper field coils, rotating at a peripheral speed of nearly four miles a minute, point to the difficulties met and overcome in generator rotor design. A book could well be devoted alone to the subject of difficulties and obstacles successfully met by research and engineering in the design of these large turbine generators.

Four buildings are at present devoted to the design and construction of this apparatus at the Schenectady plant. The two principal shop buildings are No. 52 and No. 60, partially shown in figures 1 and 2. Building No. 60 is the most interesting of the group because it houses the principal activities. In length, 803 feet and in width 341 feet, it contains two main bays each 78 feet wide, two side bays to the east and west of these, each 70 feet wide, and an additional west bay 46 feet wide. All of these bays run the full length

(*Continued on page* 83)

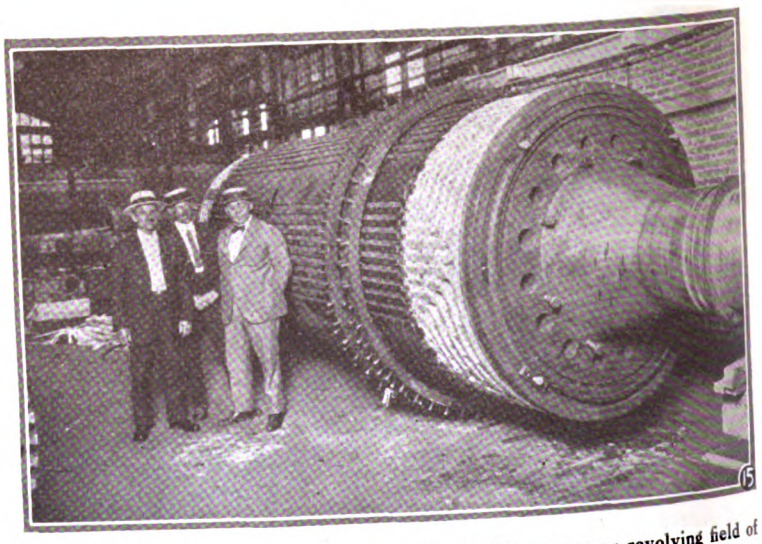


Fig. 15. The rotor or revolving field of a 62,500 kilowatt generator is shown here with its field windings in place. Huge steel bands will be shrunk over the aluminum sheaved coil ends, thus making practically a solid piece of the rotor.

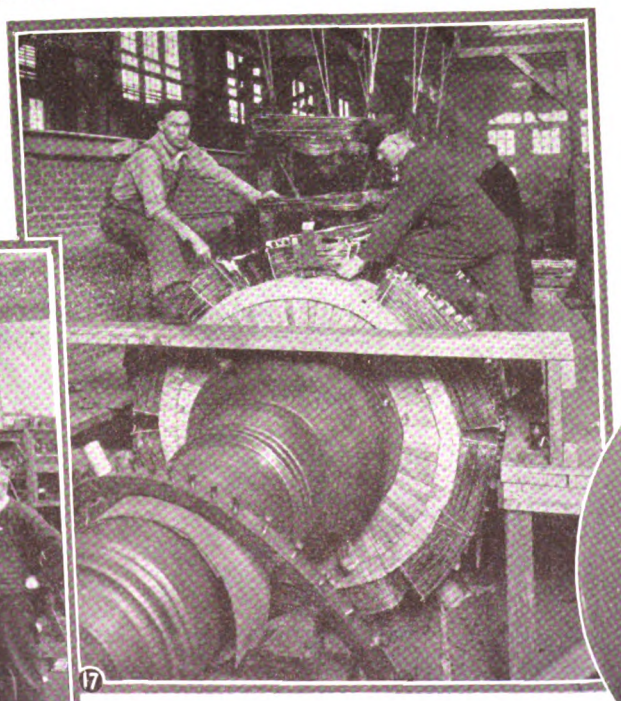


Fig. 16. A retaining ring or steel band for the 62,500 kilowatt generator. One of these is heated and shrunk on each end of the rotor.

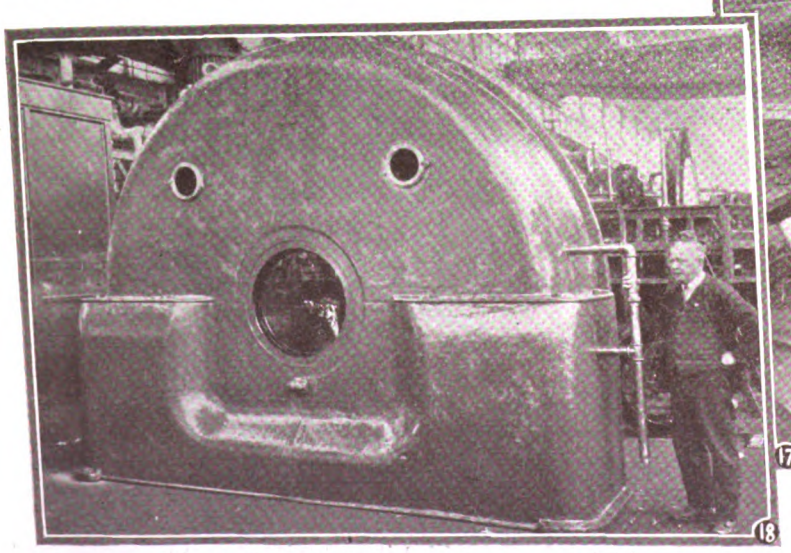


Fig. 18. Some of the largest aluminum castings ever made comprise the generator shields on a 62,500 kilowatt set. The comparative size of these is indicated by the height of the man in the above picture.

Fig. 17. Tons of copper strips in the form of coils comprise the field windings of a turbine rotor. Rotating at a peripheral speed of nearly four miles per minute the construction of these rotors calls for most advanced shop and engineering practice.

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The Question of Crating

How Scientific Method Is Saving Money for Many Firms

BY EARL CHRISTMAS

THROUGHOUT South America, there is a saying that there are three kinds of packing: "Good packing, bad packing and then American packing." A trip along the wharves of South American ports would disclose that there is considerable basis for the reflection. But you don't have to go that far away to see the tragic results of errors in packing. Any freight receiving station will bear witness to the tremendous loss from carelessness or lack of planning in packing—crates wobbly, broken or dismembered, and their contents damaged.

Unfortunately, most manufacturers don't see much of this end of the process of distribution. To many of them, the chief contact with the difficulties of shipping their goods comes when the damage claims arrive, and that, while it suggests the necessity of doing something, does not always give them the light to proceed effectively. So the order goes out to make the crates stronger, and as a rule that means more lumber.

Not a few manufacturers have stopped the damage claims, or reduced them to a minimum. How economically the results have been obtained, they have not always considered. Making crates was something for the men out in the packing room to do.

Manufacturers who are investigating the matter in a really scientific way now are being startled to find that in many cases they are using too much lumber. Engineers employed by a large lumber company, for the last year and a half, have been digging into the packing problems of big shippers throughout the country and helping them improve their crating. The tendency in the plants which the engineers have investigated is to use more lumber than necessary in crating. Almost without exception, the engineers have been able to build a better crate than the old container in use, and nearly always with less lumber.



Fig. 1. Imagine what will happen in this car when the train gives a sudden jerk or takes a curve on high speed. The battle of the boxes will be on, and victory will be for the strong. Jolts in transit and the constant weaving motion of the car wreck many weak crates.

Fig. 2. This motor was a wreck when it reached a company in Chile because an American manufacturer neglected to crate it properly for its hazardous journey.

Fig. 3. This toilet reached its destination in South America, but see—the tragic result of inefficient crating. No wonder companies in South America complain about our packing.

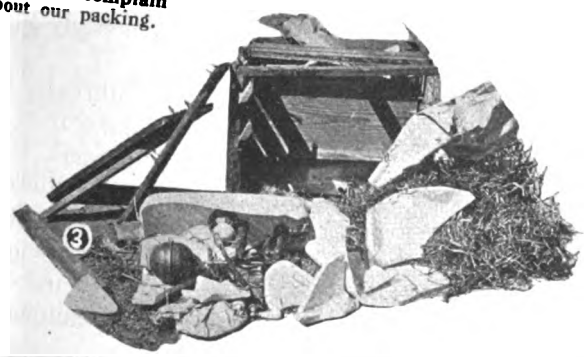




Fig. 4. This is the condition in which a box of cotton shirts and pants arrived in Chile. Yes, American packing. Imagine what a few boxes like this can do to your foreign trade!

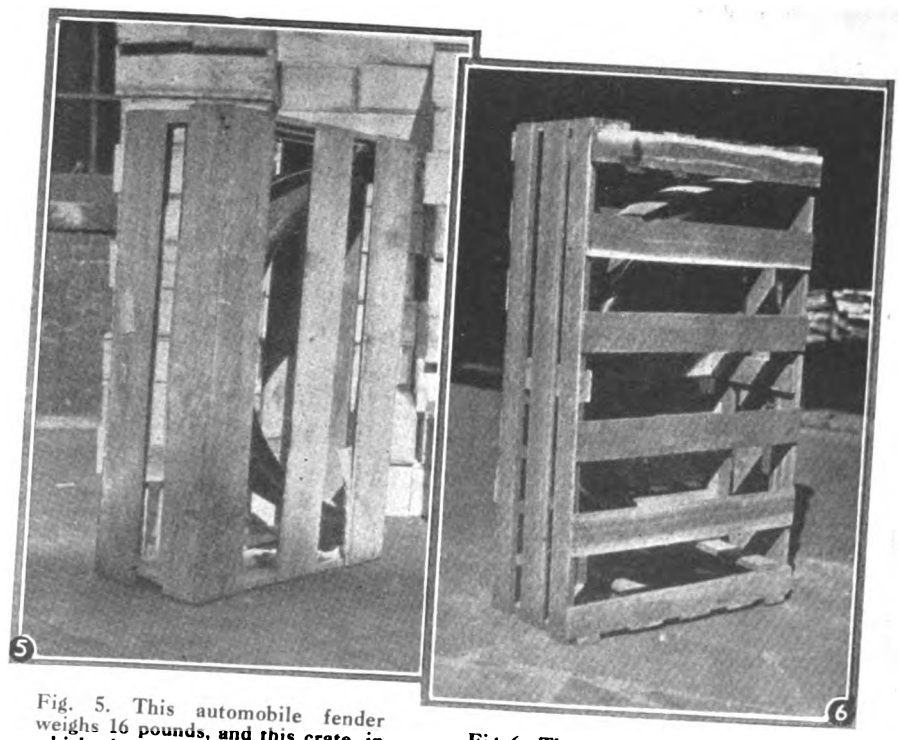


Fig. 5. This automobile fender weighs 16 pounds, and this crate, in which the manufacturer was shipping it, weighed 50 pounds. He had been using a heavy hardwood to make the crate.

Fig. 6. The picture may not show it, but this new crate, designed for the fender by the packing engineer, cut the shipping weight of the package from 66 to 30 pounds, a saving of 54 per cent. The new crate is saving $10,000 annually in freight and express bills.

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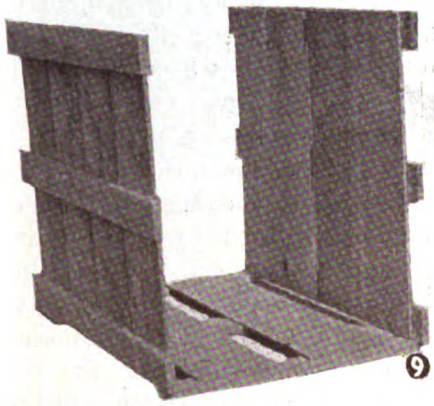


Fig. 9. Here are the side and bottom sections in place, the first step in assembling the sections preparatory to packing



Fig. 7. One manufacturer, though shipping to manufacturers in quantity, was packing one radiator in a crate like this, and was having trouble with damaged shipments, as the picture will suggest.

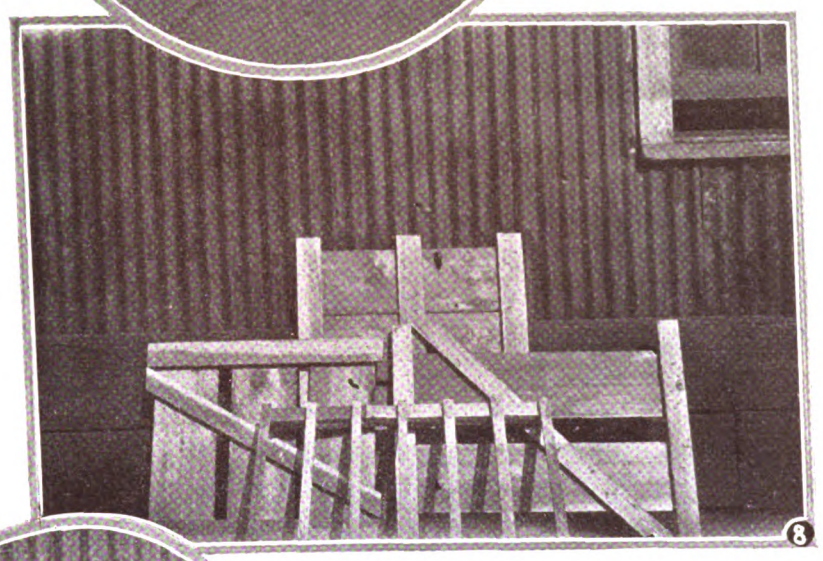


Fig. 8. The engineer designed a crate for six radiators. At the same time, he worked out a plan to build it in sections, which saves much in labor. The picture shows the four sections completed.

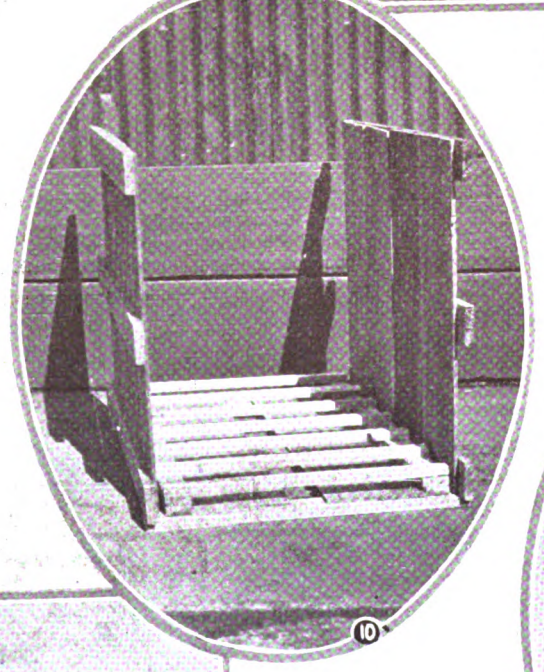


Fig. 10. To enable the crate to carry six radiators safely, the engineer designed a rack in which to nest them. The picture shows the bottom rack in place.

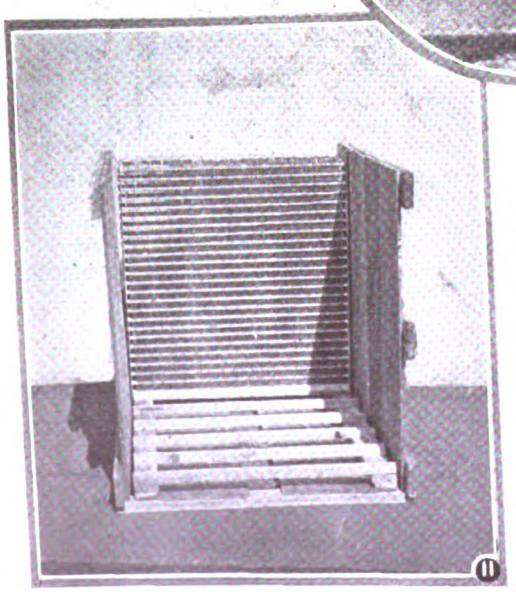


Fig. 11. This shows the first radiator in place under the new plan, the next step in packing.

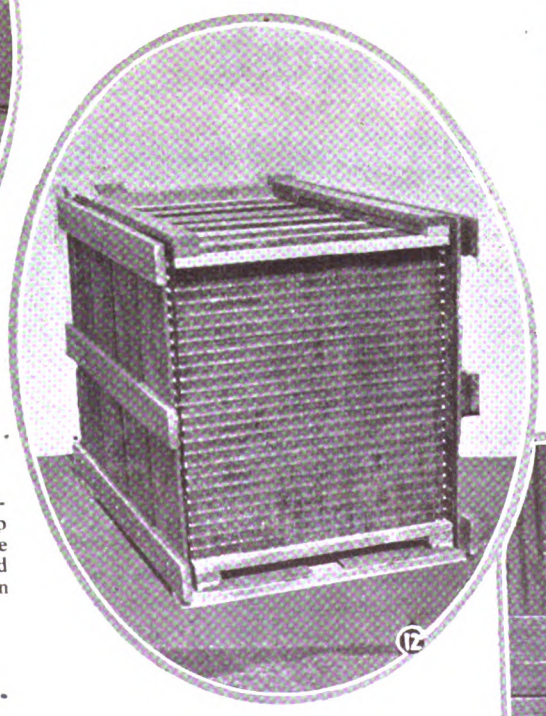


Fig. 12. With all the radiators in position, the top rack is put on. The racks, it can be seen, hold the radiators firmly in place.



Fig. 13. The new crate designed by the engineer completely assembled. Compared with the old plan of crating the radiators singly, it saves 43 per cent. of the lumber needed and 57 per cent. of shipping weight per radiator, gives much better protection and saves in labor.

So common has been this tendency to use an excess of lumber to get strength that one of the engineers says "When I go into a plant, and they begin to tell me that they haven't any losses in goods damaged during shipment, I make up my mind right away that their packing is too good, that they have been using more lumber than necessary to get protection for their goods."

Of course, some shippers need to use more lumber to protect their goods adequately. The point is that, generally speaking, crating has not been made an exact science. Even some of the best shippers, who have been seeking most earnestly to protect their goods properly, have erred grievously by overdoing the job, failing to stop when they had enough lumber in their crates; and quite generally shippers have failed to appreciate all the various means of getting strength in crates without using more lumber.

Crating is a matter for the most searching investigation and study, but the average manufacturer hasn't given it this attention. The organization mentioned made a survey of crating practices of American shippers before launching its campaign, and found an almost total disregard of many of the more fundamental principles of correct crating as worked out by the U. S. Forest Products Laboratory and those manufacturers who had made a study of the question.

Strange and unreasonable things are being done in many big industries as a result of insufficient planning or study of crating. Certainly, with some investigation, the manufacturer who was using a 50-pound crate to ship a 16-pound automobile

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fender would not have made the error he did.

Nor would an Ohio manufacturer have made the mistake he did. This man bought and cut materials for a crate, at his plant in Ohio. The materials for the crate, and the product—an 18-foot section of rubber suction hose—then were shipped out to San Francisco, where after inspection the article was crated and sent on to China. The materials for the crating originally came from the West coast. So, in effect, this manufacturer was paying freight on them clear across the country twice, when they might just as well have been bought and cut in San Francisco.

Use of the three-way corner, diagonal bracing, proper blocking, correct nailing, selection of a lumber fitted to the job—these, and many other things, with which the crating engineer is familiar, enable him to build a much stronger crate with less lumber. Knowing definitely all the hazards of transportation and the value of the different ways of meeting them, he is able to reduce the planning of a crate to some degree of exactness. Moreover, each product presents an individual problem in crating, and, as shown by experience, may have peculiar and unsuspected possibilities for saving.

Application of engineering practice to crate making is bringing about almost incredible savings in some big industries. Selecting a lighter wood, the crating engineer reduced the weight of that crated automobile fender from 66 to 30 pounds, and as a consequence this manufacturer is saving $10,000 a year on freight and express bills alone. He had

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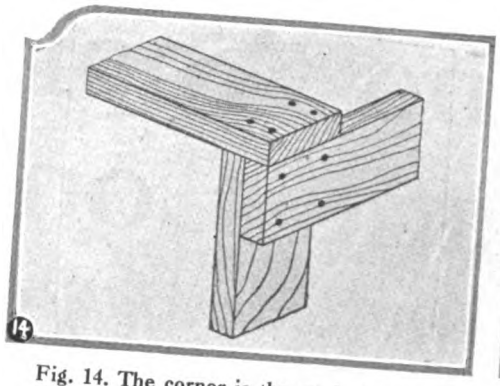


Fig. 14. The corner is the weakest part of the ordinary crate. The illustration shows a common method of crate corner construction where the lumber is not used to maximum advantage.

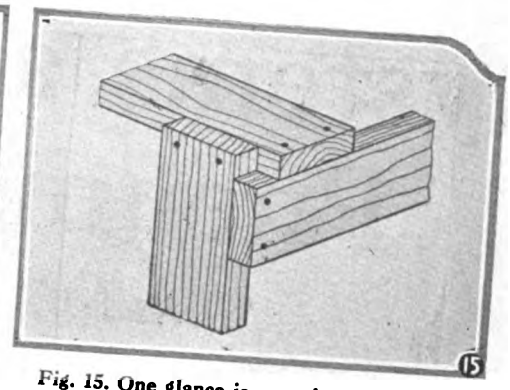
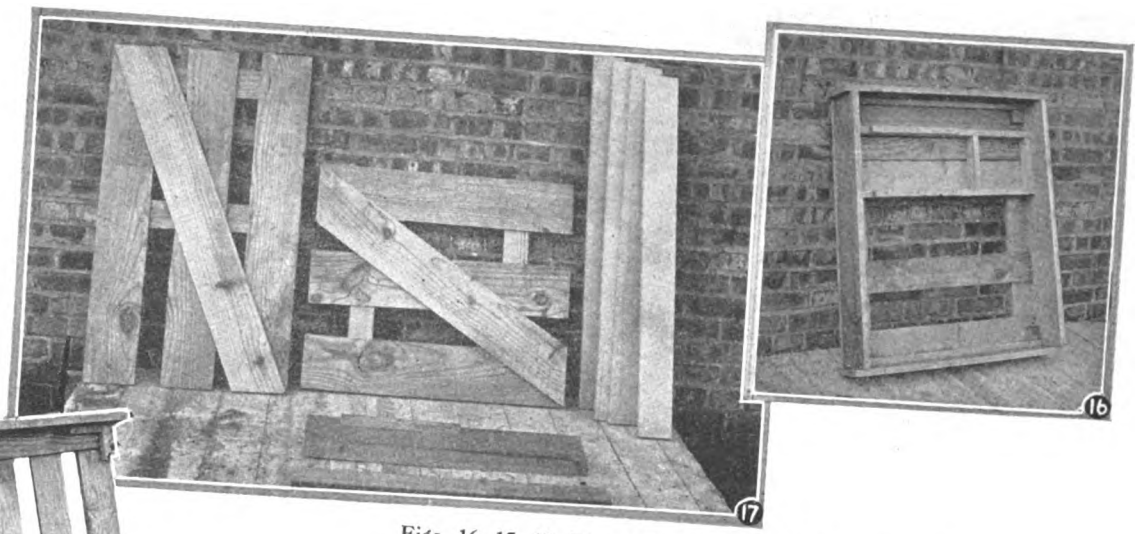


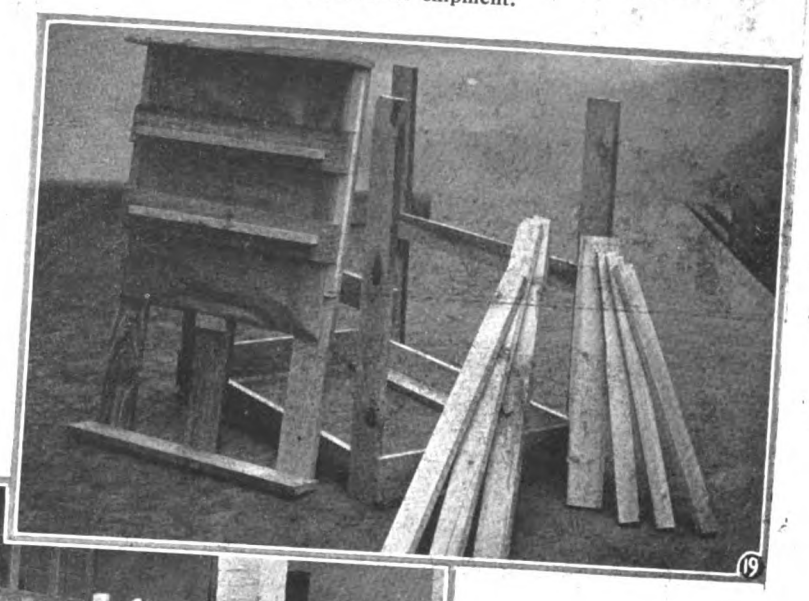
Fig. 15. One glance is enough to show the superiority of the three-way corner. Each member is nailed to another and has the third member nailed into it, and the nails are driven in the edge grain of the lumber.



Figs. 16, 17, 18. The packers in a washing machine factory had been cutting and fitting lumber for the crate in the shipping room. The crating engineer worked out a plan for building it that cut down the labor required one-half. The crates now come into the packing room in sections, and the packers simply put the sections together when machines are prepared for shipment.



Fig. 19. These two pictures (19 and 20) illustrate the advantage of sectional construction in building crates. The picture at the right shows all the parts for the completed crate, partly assembled, so that with a minimum of labor the washing machine may be put in and sent on its way. This is a good illustration of how far the process may be carried.



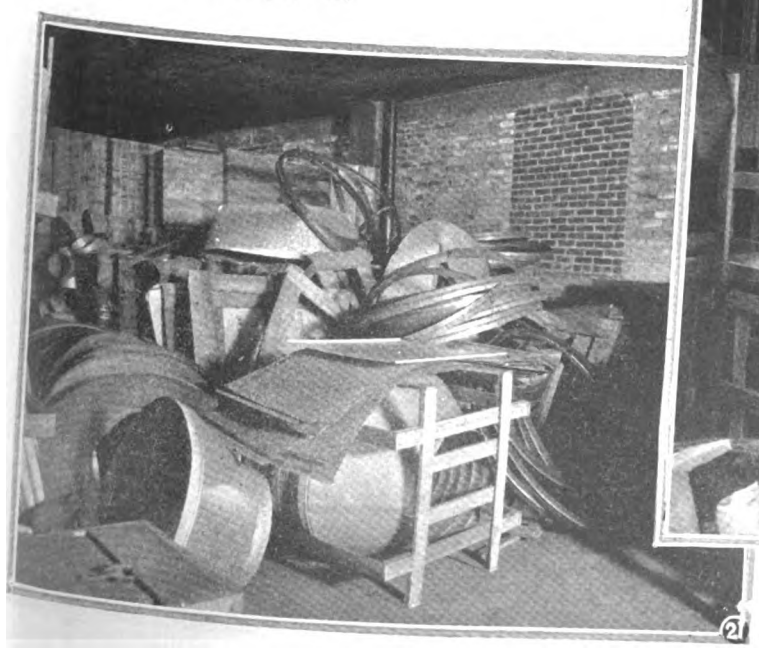




Fig. 21. One manufacturer, shipping to retailers, crated his furnaces together, putting the same parts in one crate. To assemble one, it was necessary to get a piece from ten or twelve crates. **This retailer no longer handles this furnace!**

Fig. 20. Besides saving time in building, sectional construction has a big advantage in that workmen can make up parts in advance, when work is slack in packing or other lines. The picture at the left shows the partly assembled crates standing ready for the packer. Instead of building a crate as he needs it, the packer thus has at his elbow crates with nearly the whole job of building already done.

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Systems and Application of Pneumatic Conveying

Handling Dry Bulk Material in Pipes

By Matthew W. Potts



Fig. 1. The domestic use of pneumatic conveying commonly called a vacuum cleaner.

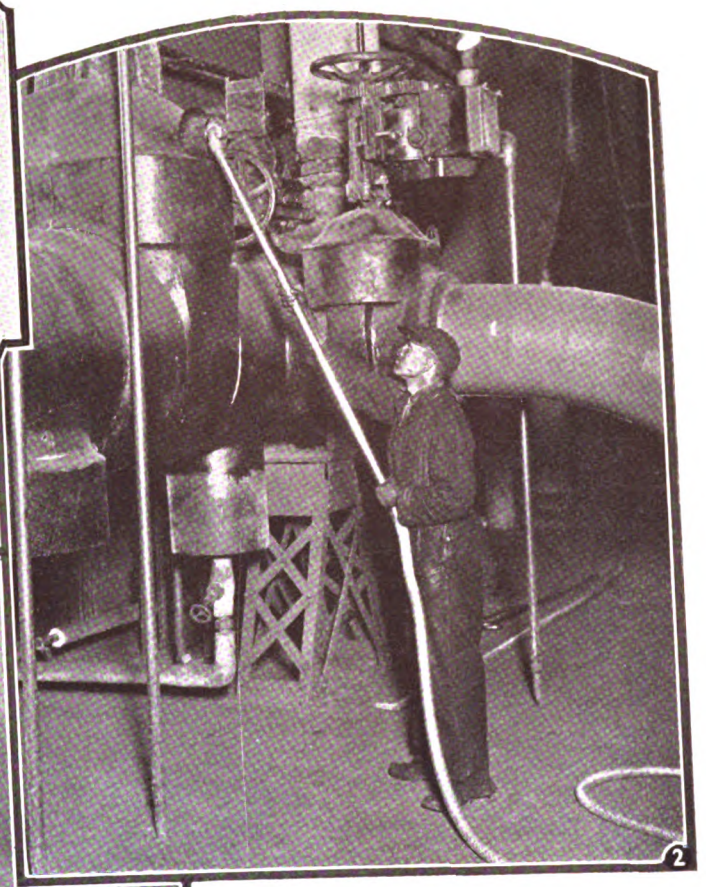


Fig. 2. Industrial cleaning is a long step from the domestic type shown in Fig. 1.

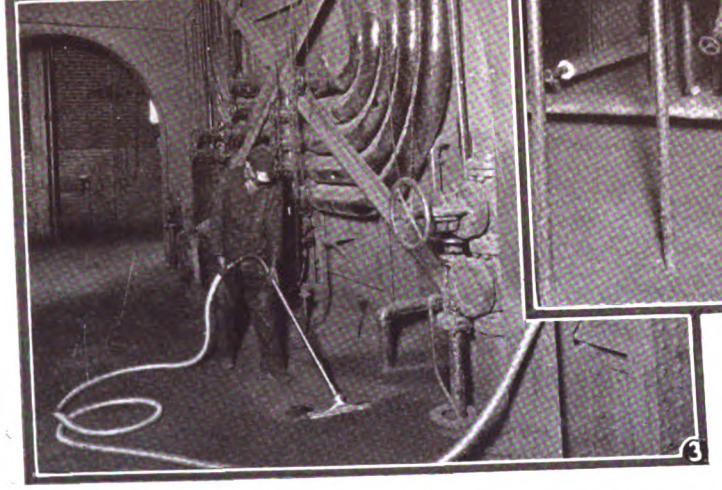


Fig. 3. Industrial cleaning systems are frequently conveying systems because of the volume of material handled.

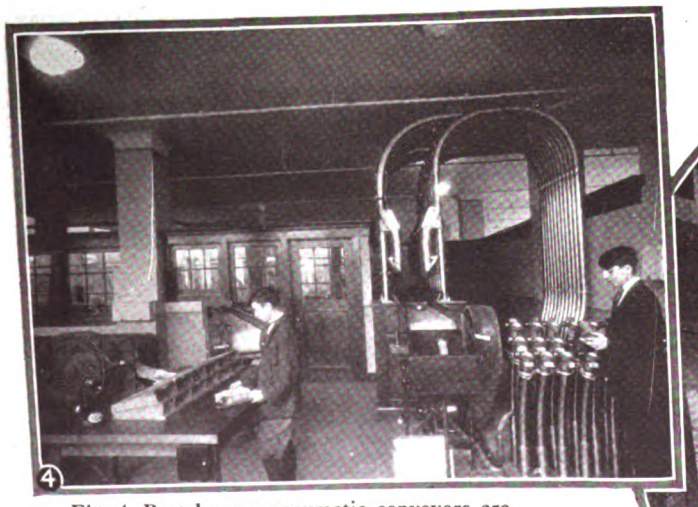


Fig. 4. Best known pneumatic conveyors are the types used in department stores.

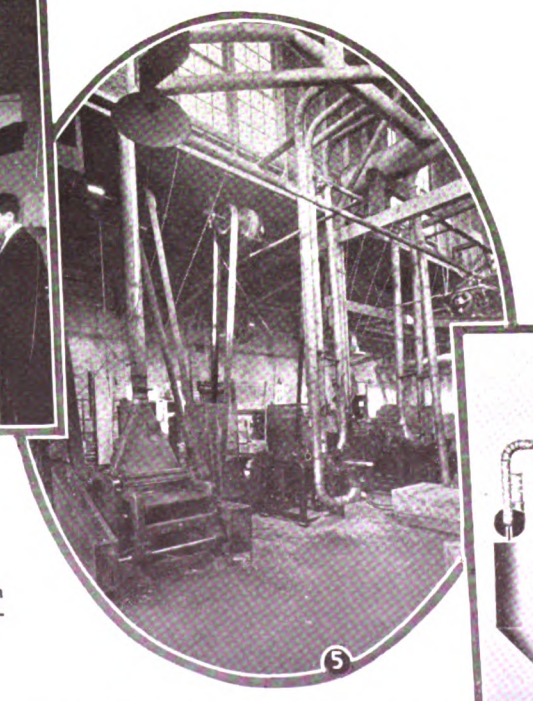


Fig. 5. Collecting of shavings, such as from wood-working machines, is a form of pneumatic conveying.

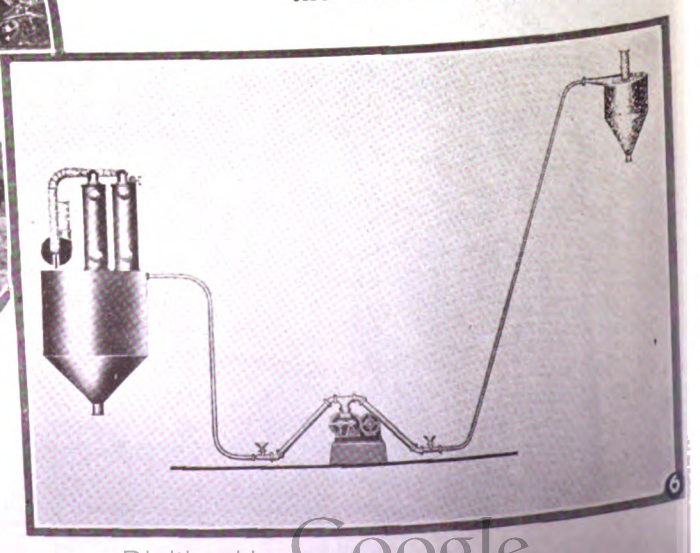


Fig. 6. Showing two diagrammatic layouts of bulk pneumatic conveying systems.

PNEUMATIC conveying has recently attracted great and widespread interest among engineers and others who are investigating the economical handling of materials. The information heretofore available on the subject has, however, been so meagre and so indefinite that it is felt advisable to present this concise outline of principles, methods and application.

The high cost of labor, coupled with the desire to improve the conditions of the worker who has to work in a dust-laden atmosphere of an objectionable or even poisonous nature, has created a demand for pneumatic conveying plants, and many new small and large installations are now being erected.

The principles of pneumatic conveying have been in use for a considerable time, although until recently only a few materials have been successfully handled. Engineering progress in the last few years, however, has increased the field of this method, and made it an important feature in the materials handling world. In this article, brief mention will be made of the various systems in use, and many examples will be given of installations in various fields, which have solved labor difficulties, cut costs, and improved conditions generally.

It was the need of water for human consumption and for irrigation purposes that caused the ancient inventors to carry

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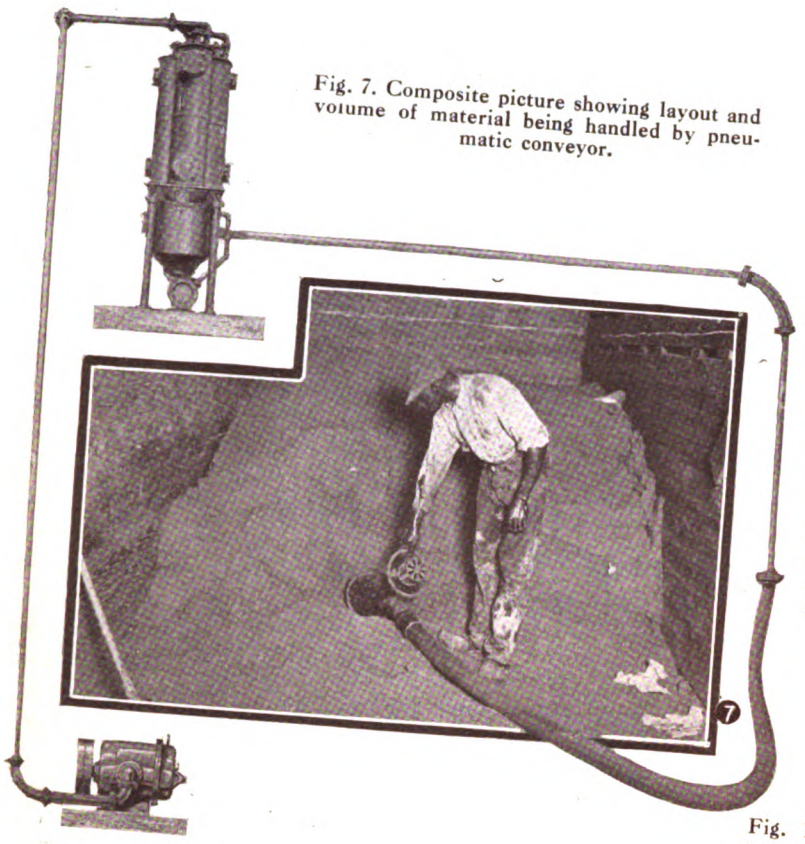


Fig. 7. Composite picture showing layout and volume of material being handled by pneumatic conveyor.

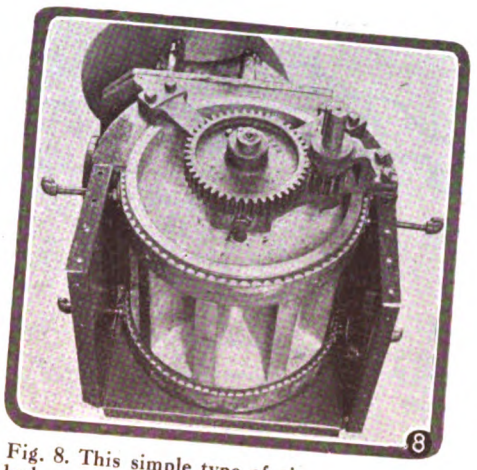
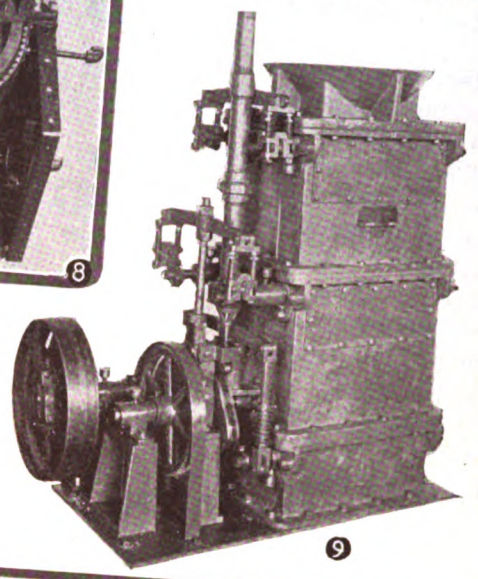


Fig. 8. This simple type of air lock was the limiting feature for many years to the broad application of bulk materials handling by the pneumatic principle.

Fig. 9. The new type multiple stage air lock has overcome the disadvantages of the simple air lock previously shown.



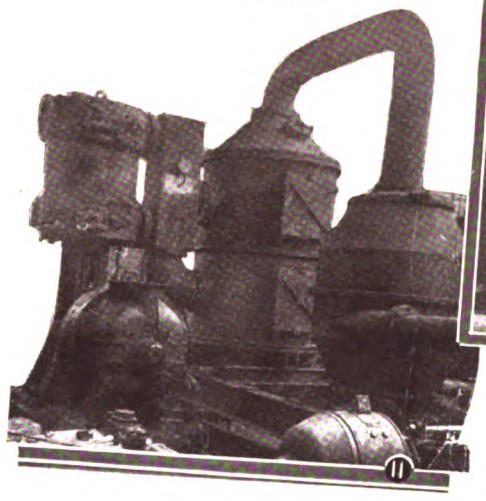


Fig. 11. Shop assembly of vacuum pump filters, etc., for large installation of pneumatic conveying of British manufacture.

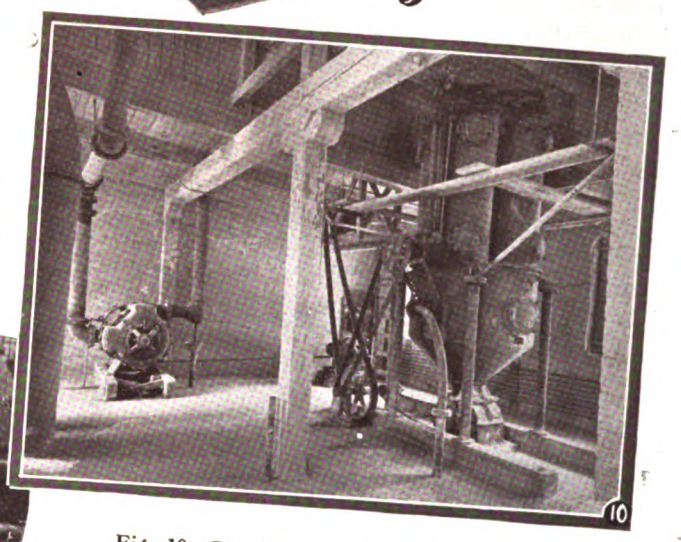


Fig. 10. Complete installation of vacuum pump filters and simple air lock by American manufacturers.

out nearly all of their experiments with that substance, and the first instance we have of anything approaching pneumatic conveying is the well-known injector, in which steam is passed through one pipe placed at right angles to a second pipe at such a pressure as to reduce the pressure in the second pipe to below the atmospheric pressure. The excess of atmospheric pressure over the reduced pressure in the second pipe then forces up the material (in this case water) into which the end of the pipe is submerged.

This invention is about a century old, if it emanated from the Marquis Mammonry d'Eclet, in 1818, as is usually believed. The first practical application of this invention to other than liquid materials was supposed to have been in connection with the conveying of cotton in loose form, as an improvement on the manual shifting of large bales. This development was made about 1867, and from this date gradual progress was made, principally in connection with the handling of grain, wheat malt, etc.

At present, it is hardly possible to enumerate all the successful schemes for the pneumatic handling of materials. In addition to the installation for the conveyance of materials such as those mentioned above, is the pneumatic tube for conveying papers, messages and cash in offices, and between shop

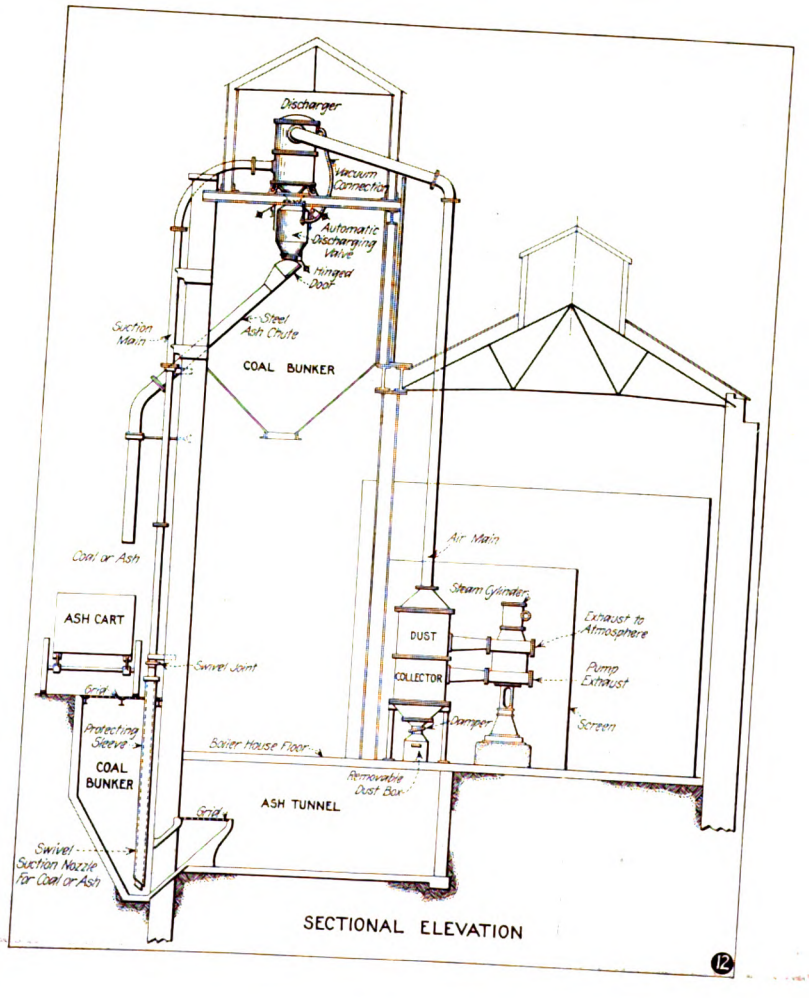


Fig. 12. Diagrammatic layout of coal and ash handling system for Messrs. Wardell & Davenport, Ltd., Leeds.

counters and cash desks, etc., as shown in figure 4. This is really the best known pneumatic conveyor, and one that has had considerable development in this country. Also there is the suction cleaner, the domestic type of which is called vacuum cleaner, and which is shown in figure 1; and there is the industrial suction cleaner, ranging in application from the handling of refuse and dust from saw mills, wood working machinery, grain elevators, etc., to the removal of fine abrasive and poisonous particles in certain manufacturing processes. Illustrations are shown in figures 2 and 3.

Pneumatic systems for collecting shavings and transporting like materials in large pipe lines have been in use for many years. In these installations, large fans generate the air currents for conveying the materials. Figure 5 shows an installation of such equipment.

The sand blasting machine, used extensively in the larger cities for cleaning buildings of

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the dirt which has accumulated on them since the use of soft coal became necessary, is really another example of a self-contained pneumatic conveyor on a small scale.

While steam is mentioned as the first medium for producing the air current, some materials cannot be handled unless they are carried in absolutely dry gas. In the strict sense of the term, pneumatic conveying really implies the conveyance of a quantity of material from one point to another, by means of air as a conveying agent.

It will be seen from the above that the subject embraces the removal of a comparatively light dust produced in many industrial processes, which is not considered ordinarily as pneumatic conveying, although the same name is applied to all types and installations. The methods to be adopted vary, and each case must be considered on its own merits.

It is regrettable that in some cases ordinary vacuum cleaning machines, such as shown in figure 1, and slightly larger units, have been sold to manufacturing establishments upon the representation that they are suitable for the collection of dust and fine materials. These operate successfully if the dust and sweepings are not of large volume, but the ordinary small vacuum cleaner as used in homes, hotels and office buildings, is not of sufficient capacity for the majority of installations in industrial establishments. Naturally the results have been somewhat unfavorable and caused prejudice against this method of dust removal, which is most unfortunate, because a system properly designed and of sufficient capacity would have solved the problem.

In the boiler room of the immense Central Station (Colfax), a pneumatic sweeping system is used to keep the boiler room in a clean and inviting condition. All the coal siftings and the dirt and dust accumulations on the boiler tops, boiler exteriors, piping and structure, are picked up and lifted to an overhead collector from which this combustible material is delivered into the stoker hoppers. Figure 2 shows the method of sweeping off the pipes, etc., while figure 3 shows the large quantity of coal siftings which are being picked up by this pneumatic sweeping system.

A pneumatic conveying plant of practically any type, com-

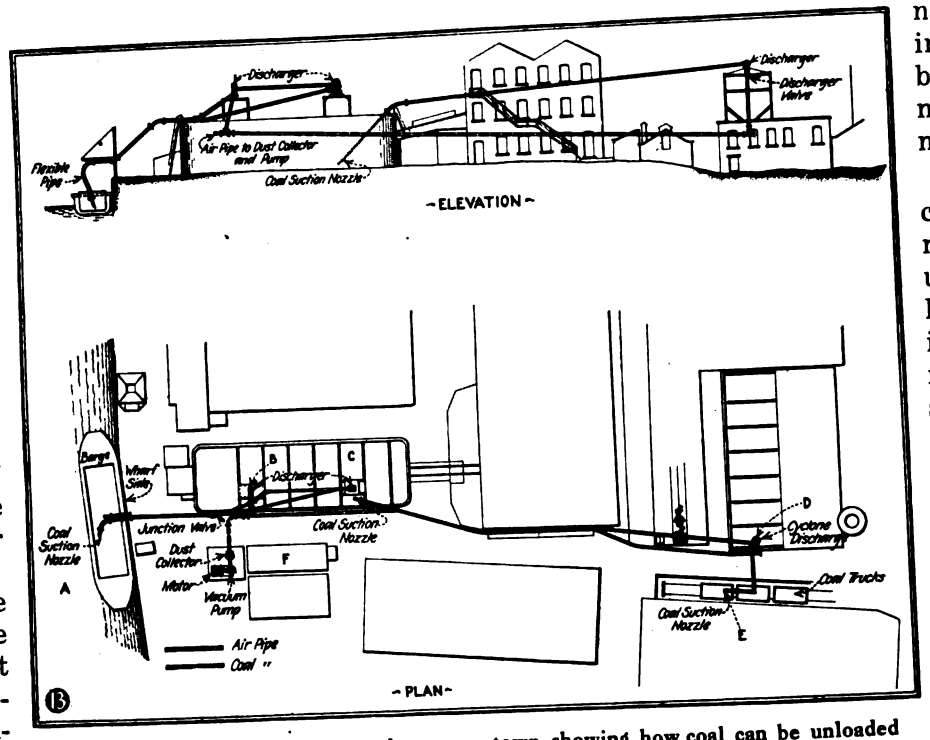


Fig. 13. Diagrammatic layout of pneumatic coal conveying plant of the India Rubber & Gutta Percha Co., Ltd., Silvertown, showing how coal can be unloaded from barge or coal lorries for delivery to boiler house.

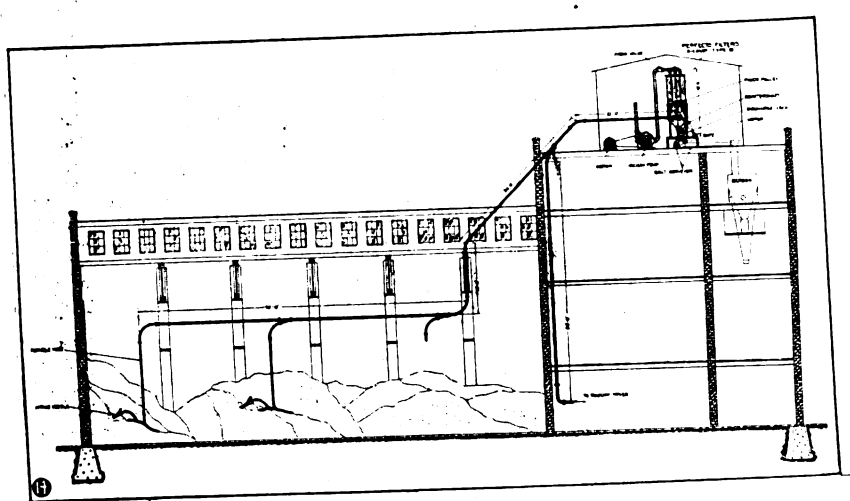


Fig. 14. Diagrammatic layout of pneumatic conveying system in large packing house, dry bone and bone dust storage. Installation of pneumatic conveyors saved the wages of twenty men.

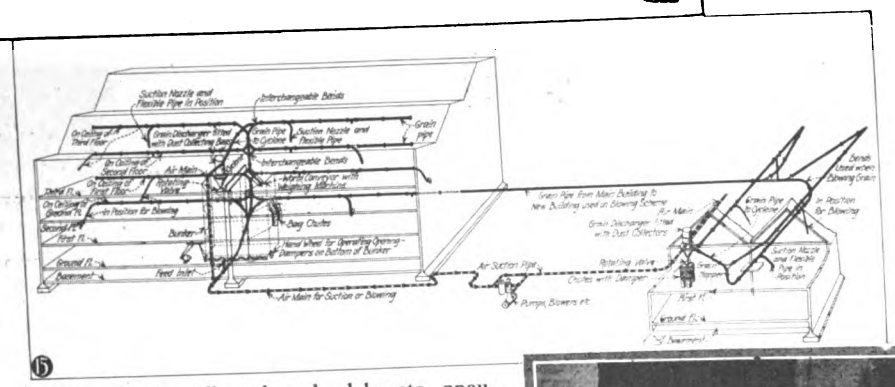


Fig. 15. Complicated and elaborate pneumatic conveying installation for handling dry brewer's grains which are used as cattle feed.

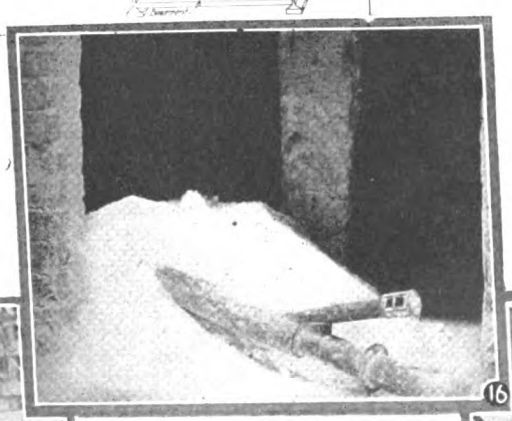


Fig. 16. Close-up view of pneumatic conveyor nozzle, taken inside arsenic settling chamber, and showing method of loading conveyor.

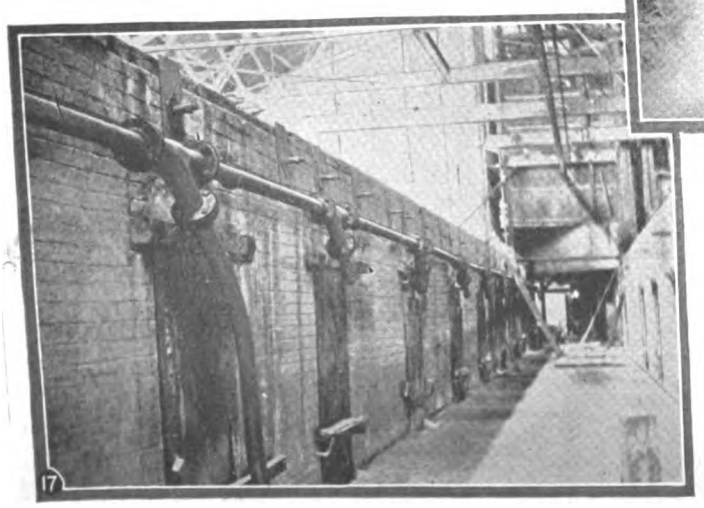


Fig. 17. View showing pneumatic conveying pipe with Y connections for flexible hose, which are placed in arsenic settling chambers for handling materials.

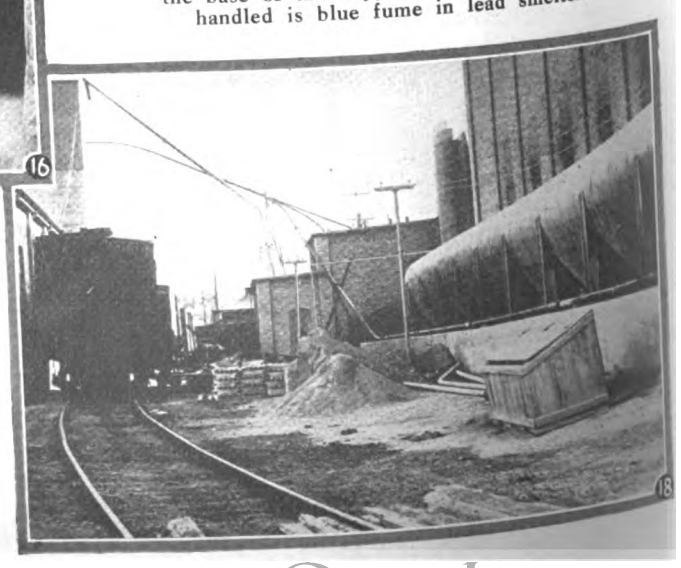


Fig 18. Simplicity of installation is one of the main points in favor of pneumatic conveying. The pipe and flexible hose shown is the pneumatic conveyor, and the material intake is at the base of the hopper. The material being handled is blue fume in lead smelter.

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prised the following five main components:

First: a vacuum pump or exhauster to create a partial vacuum in the pipe line and so induce a high velocity air current in which the material will be conveyed.

Second: An air filter in which any light dust carried beyond the discharger is trapped to prevent its entering the exhauster, where it would quickly damage the piston rings and cylinder walls of a reciprocating pump.

Third: Main receiver or discharger, and occasionally one or more subsidiary receivers, in which the conveyed material is extracted from the system and discharged into a receptacle or on to a dump, conveyor, etc., as required.

Fourth: The pipe line junctions, etc., to connect the point of supply with the point of delivery.

Fifth: Suction nozzle, through which the materials enter the system together with the free air which is to act as the conveying medium.

With regard to the installation of a conveying plant proper, points for consideration in the initial stages are as follows:

1. The nature of the materials to be handled and the quantity required in a given time.
2. The size of the largest and smallest piece of material and the density.
3. Percentage of moisture. (Materials should be dry or nearly so.)

(*Continued on page* 73)

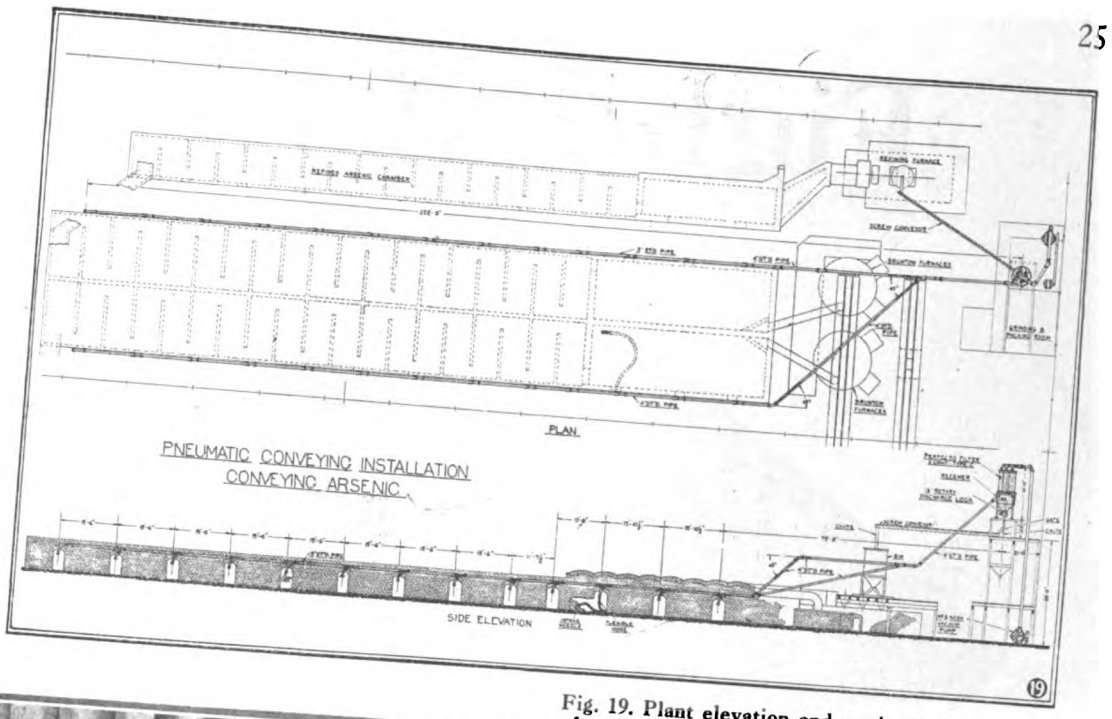


Fig. 19. Plant elevation and sectional views of pneumatic conveyor for handling arsenic from settling chambers. This is the same installation as shown in photographic views 15 and 16.

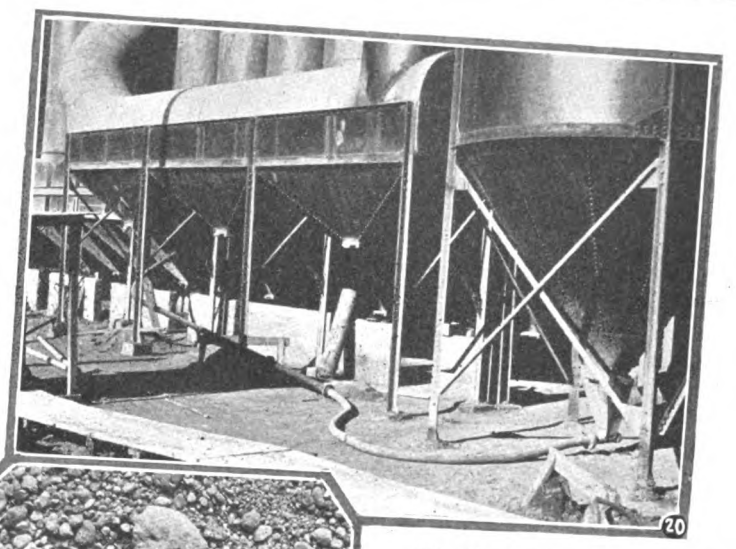


Fig. 20. Continuation of installation shown in figure 18, showing method of transporting blue fume over railway tracks, buildings, etc., to bin storage for car loading.



Fig. 21. Pneumatic conveying is not limited to fine or soft materials. Here is shown phosphate rock (one-third size) which is now being successfully conveyed.



Fig. 22. View in hold of ship with unloading well advanced, showing nozzle and pipe line handling phosphate rock as shown in figure 21.

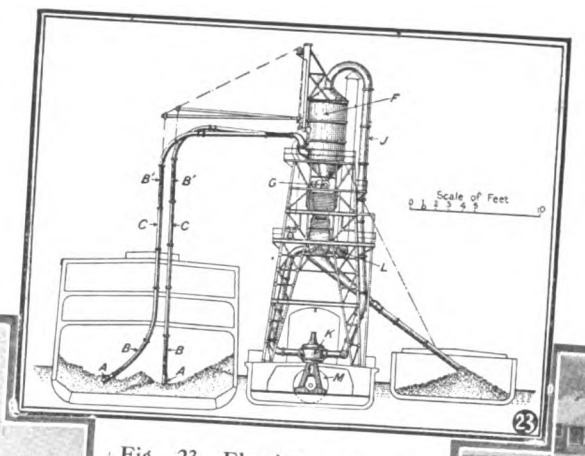


Fig. 23. Floating pneumatic transfer plants have not appeared in this country, but are successfully operating in England. The one shown above can handle from 200 to 250 tons of grain per hour.

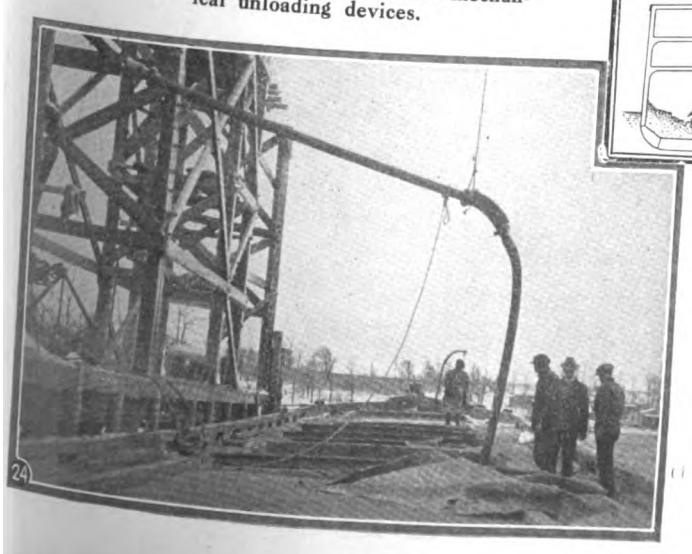


Fig. 24. Shows conditions under which operation was being made in figures 20-21. The cold, ice and sleet, also rain, would have given considerable trouble to other mechanical unloading devices.

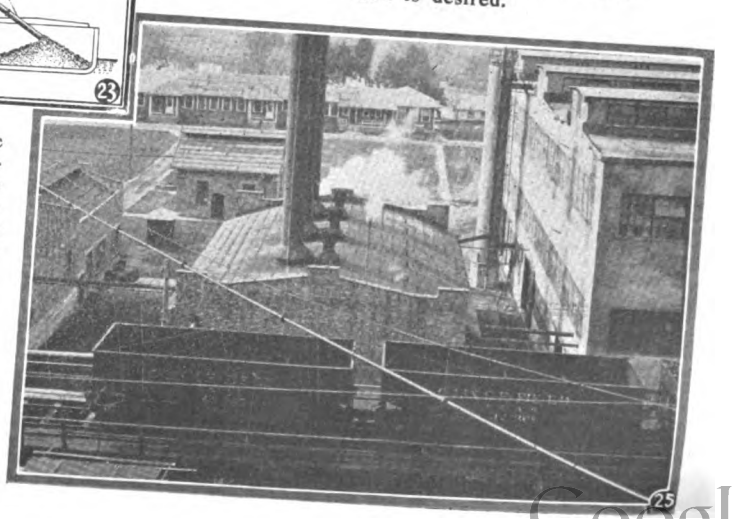


Fig. 25. Pneumatic conveyors can be suspended from building to building by cable as shown, thus eliminating expensive bridges and superstructures when installation is desired.

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Fighting Friction in the

How Lubrication Science

BY ALLEN F.

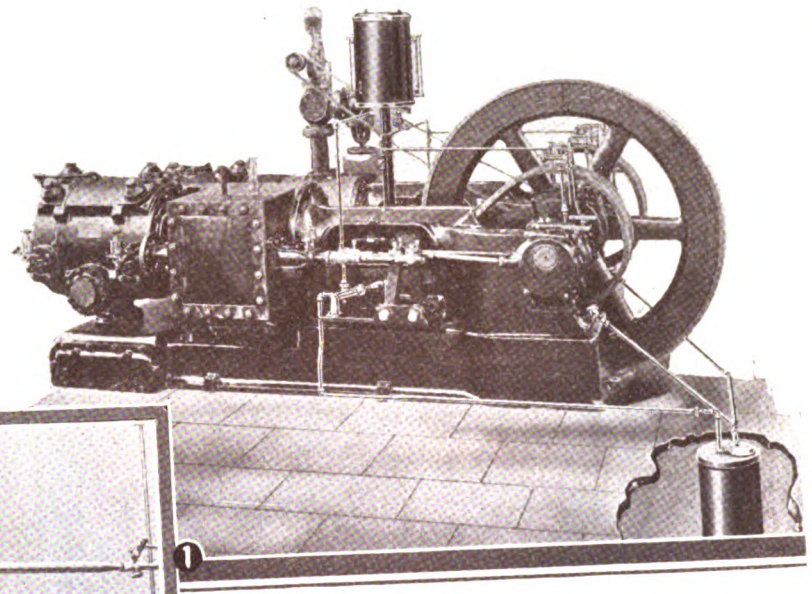


Fig. 1. Individual oiling and filtering system on an air compressor installation. Oil piping can be clearly followed.

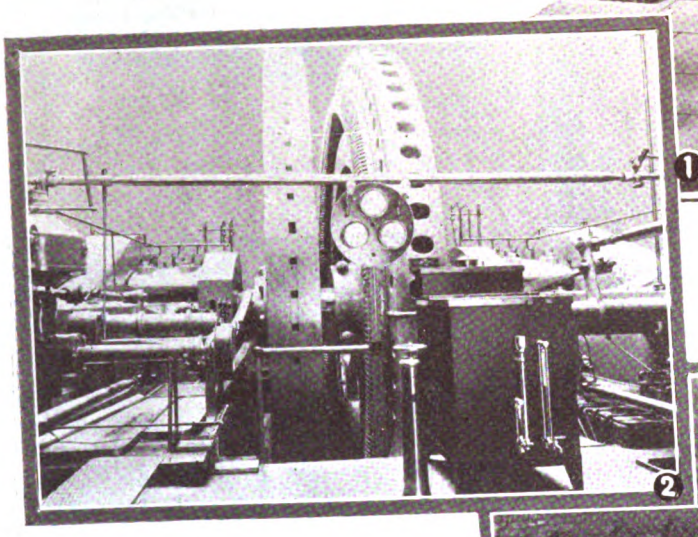


Fig. 2. Cross Compound Corliss engine equipped with an individual oiling and filtering system. Oil piping details and filter are in clear evidence.

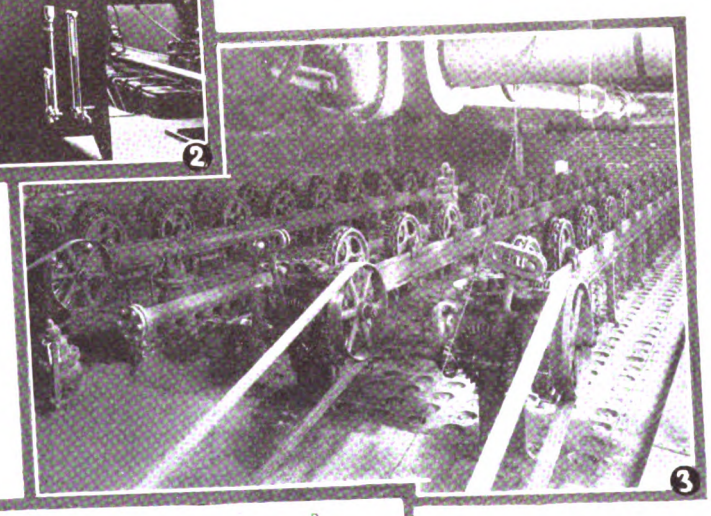


Fig. 3. Details of scraper driving and reversing mechanisms on a modern economizer installation. Considerable heat is often present in such locations and careful attention to lubrication is necessary.

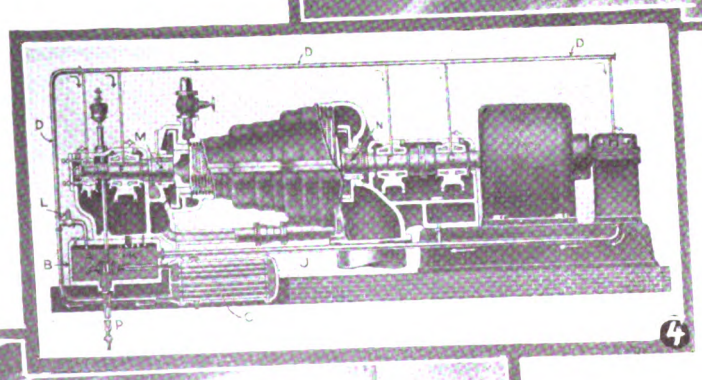


Fig. 4. A self-contained oil circulating system on a steam turbine. Legend: B, Oil reservoir; C, Oil cooler; A, Turbine oil pump; D, Main oil line; E, F, G, and H are bearings; J, Return oil line, etc.

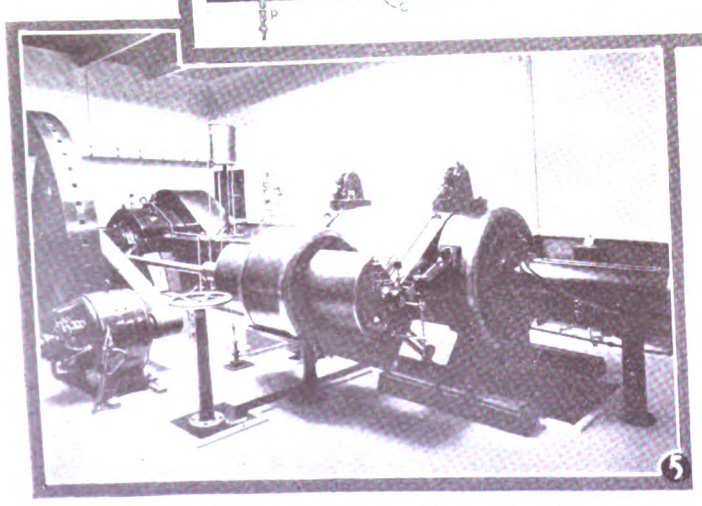


Fig. 5. A poppet valve engine equipped with an individual oiling and filtering system.



Fig. 6. Gas engines equipped with gas engine lubricators. There are a total of over 1,800 feeds in this installation.

TO a layman, perhaps one of the most impressive experiences is to make a tour of inspection of a modern power plant. To listen to the rhythmic drone of a huge turbo-generator, or to watch a modern Corliss or Uniflow engine in operation is apparently an awe-inspiring attraction to us all. But as often as not we will, on turning away, remark upon the wonders of electricity or the marvelous power of steam, and lose sight completely of a factor without which neither our steam or electricity could function. In other words, steam, electricity or water power is ineffectual without lubrication.

Whatever the type of machine, its motive power or principles of operation, somewhere there are certain bearing surfaces in more or less close contact wherein friction is a vital factor. Under modern high speed conditions this frictional resistance must be overcome. It used to be possible to operate certain of such machinery at relatively low speeds, and with comparatively high clearances between bearing surfaces. As a result, while friction imposed a heavy load upon the machine, and bearings naturally overheated, yet temperatures did not tend to rise to a dangerous extent. Perhaps lubrication would be applied to such bearings, per-

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Modern Power Plar

Helps to Cut Power Costs

BREWER

haps not. It all depended upon the installation and the ability and judgment of the engineer. At all events, any lubricant that was used frequently happened to be a relatively crude product, and many times entirely unsuited to operating conditions. We have but to look back to the "old tallow pot" which perhaps our uncle kept simmering on the steam-chest of his saw mill engine, etc., to appreciate all this; or to review the many times some of us have soused a line shaft bearing with a shot of waste oil.

Tallow and lard are excellent lubricants, but science and research have proven that they are most effective when in compound with mineral oils. So it has also come about that science and research have proven that lubrication is relatively the keynote of modern power plant efficiency. The high speed turbine and the multiple expansion condensing steam engine, oftentimes operating on superheated steam, soon proved to us that no longer could we shoot a dose of tallow into steam cylinders, or increase clearances or perhaps squirt an extra allotment of oil into bearings now and then. Scored cylinders, compression losses, and burned-out bearings made it essential that all such

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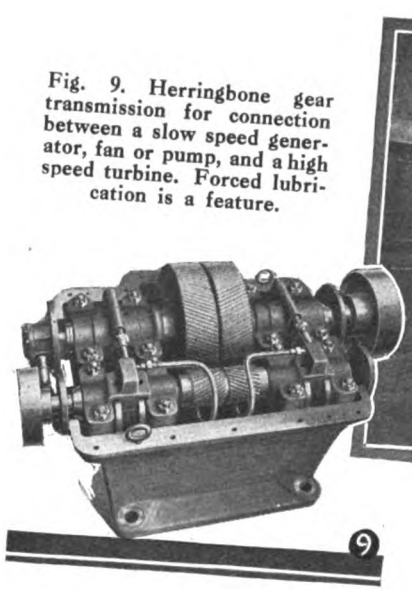


Fig. 9. Herringbone gear transmission for connection between a slow speed generator, fan or pump, and a high speed turbine. Forced lubrication is a feature.

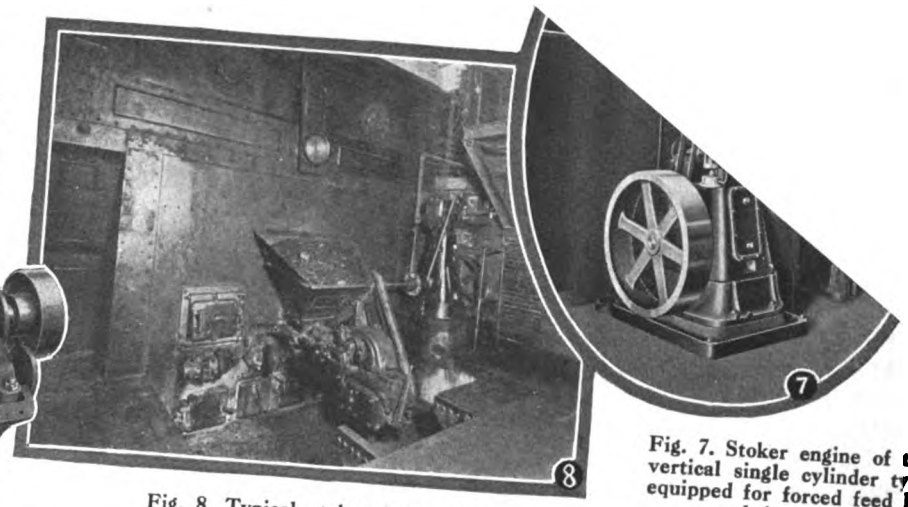


Fig. 8. Typical stoker installation as applied to a low set boiler. Note driving engine and chain transmission, etc.

Fig. 7. Stoker engine of the vertical single cylinder type equipped for forced feed lubrication.

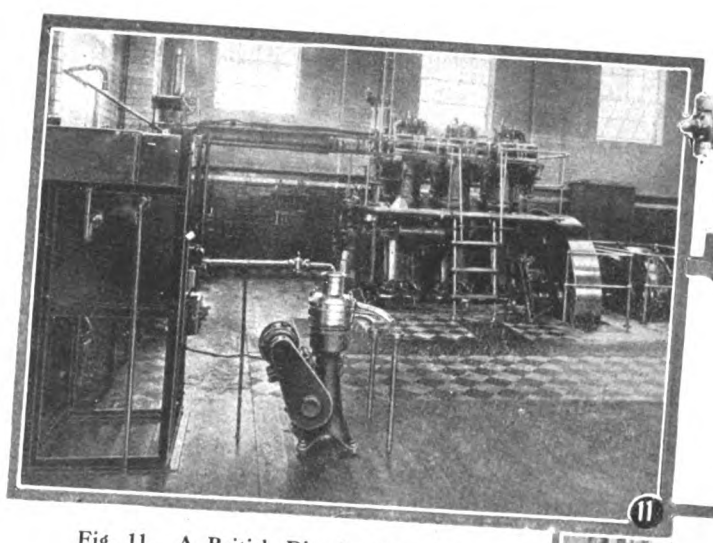


Fig. 11. A British Diesel engine installation, showing certain of the lubricating piping and the oil purifier attached.

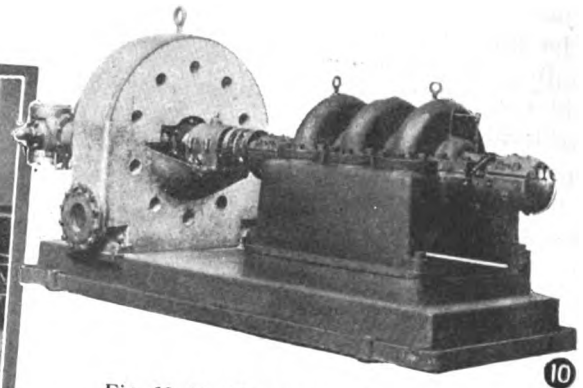


Fig. 10. Turbine driven, three stage centrifugal pump. Bearing lubrication is decidedly important on such an installation.

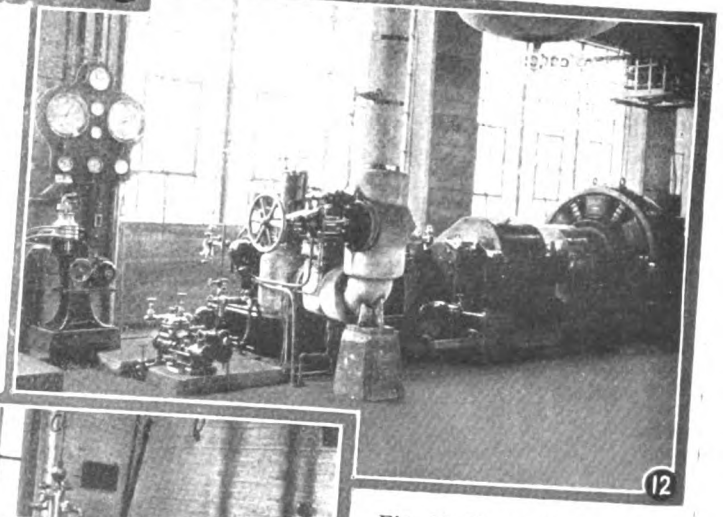


Fig. 12. Especially in turbine work is purification of the lubricating oil an important factor. Both lubricating equipment and purifier are here shown.

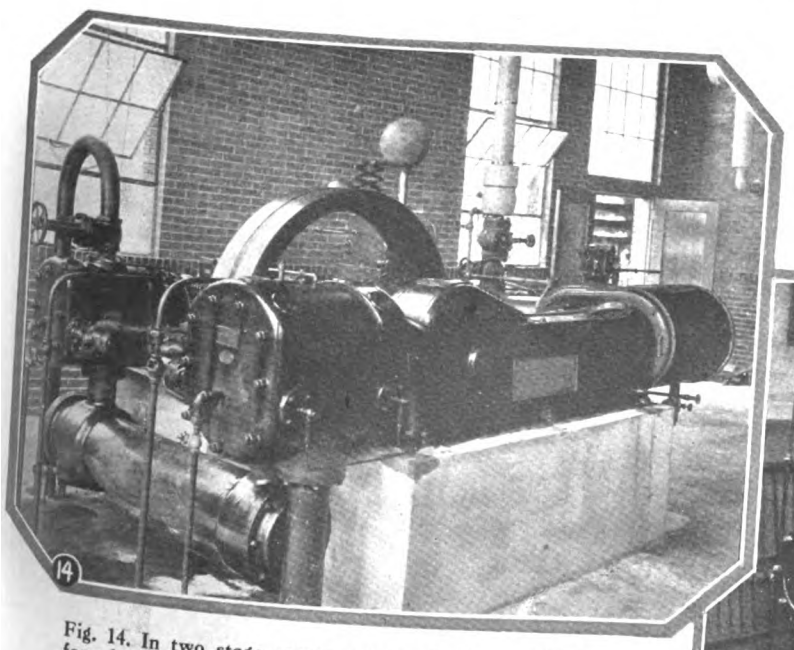


Fig. 14. In two stage compressors and other multiple types forced feed lubrication of both steam cylinders and air cylinders is the most positive. Other bearings are often lubricated by some form of splash or forced feed lubrication.

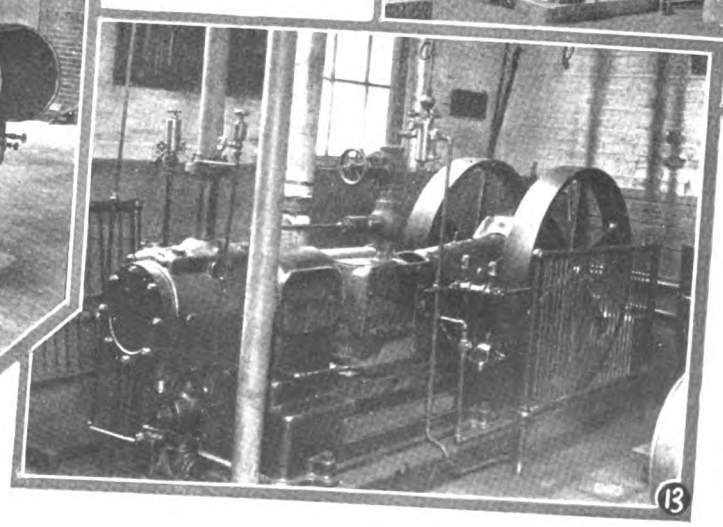


Fig. 13. The hydrostatic lubricator for steam cylinder service, and the sight feed oiler are often applicable to single stage air compressors.

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ıking Labor Appreciate the Labor-Saving Idea

By E. T. Bennington

Manager, Cleveland Electric Tramrail Division,
The Cleveland Crane & Engineering Co.

THE action of the present Administration at Washington in limiting the immigration of labor is beginning to be felt by all industries.

This has brought about an unusual demand for labor saving and materials handling machinery which is likely to continue for some time to come. Industries that formerly were very wasteful in their use of labor have been forced by necessity to devise ways and means of overcoming their problems of production and handling in a more efficient manner.

The application of materials handling machinery presents a problem which is given too little consideration by the operators of some plants. In order to get all out of a labor saving device that is built into it, it is necessary to have the employees who operate these machines, in a frame of mind that will permit their doing the best they can to see that the equipment performs the functions for which it is designed. It is impossible to get the employees in a frame of mind to welcome labor saving devices unless an effort is made to show them that their own best interests are promoted through the use of such equipment.

The substitution of machinery for manual labor has been increasing continually for the past several years and is likely to continue to increase for some time to come and to replace many forms of common labor in the performance of tasks which should have been handled by machinery long ago. The increase in the use of labor saving and materials handling machinery, especially as applied to industrial plants, is not looked upon with favor by some labor organizations and in a great many instances is met with resistance on the part of laboring men. This resistance is undoubtedly prompted by a desire to promote the best interests of the laboring man.

An investigation of the subject will disclose that the interests of the laboring man are promoted rather than retarded by the use of labor saving machinery.

The process of evolution is bound to take this course. It is only a matter of time until all of the disagreeable, heavy and

(*Continued on page 60*)

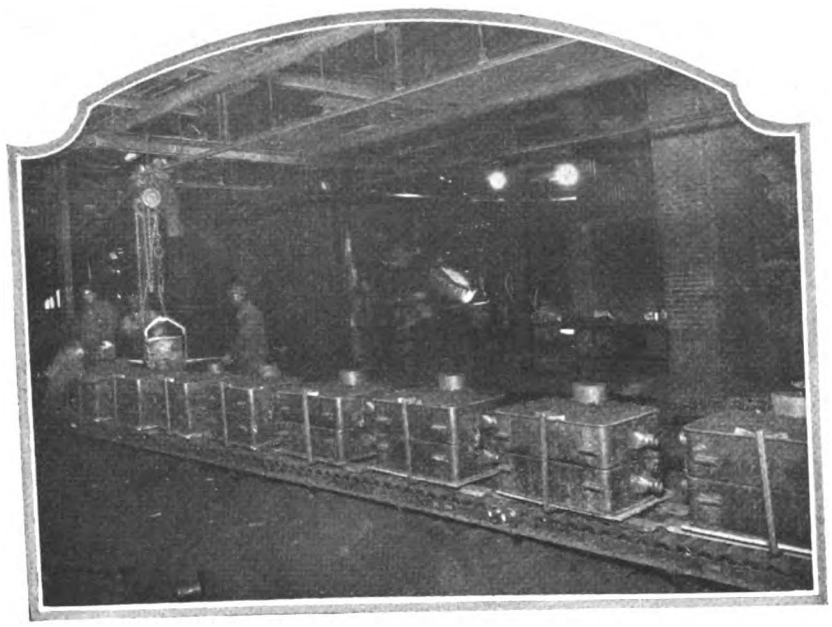


Fig. 1. Pouring molds in the foundry, with the help of an overhead rail and hoist.

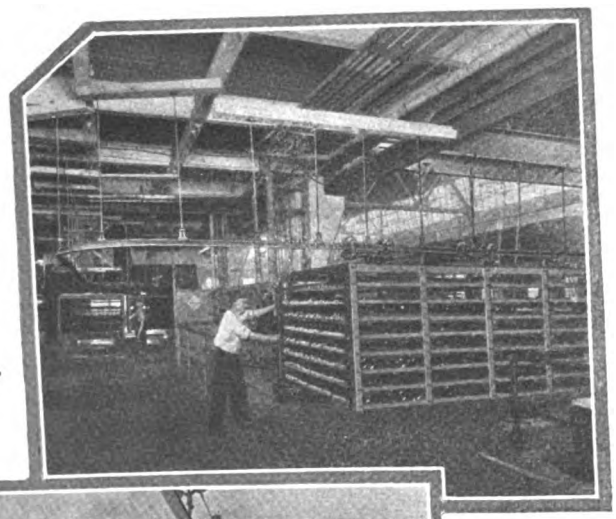


Fig. 2. These cages of japanned parts, weighing up to two tons, are readily handled by one man.



Fig. 3. This motor-operated hoist, which is in almost continuous operation through the working day, has the operator's platform equipped with a seat.

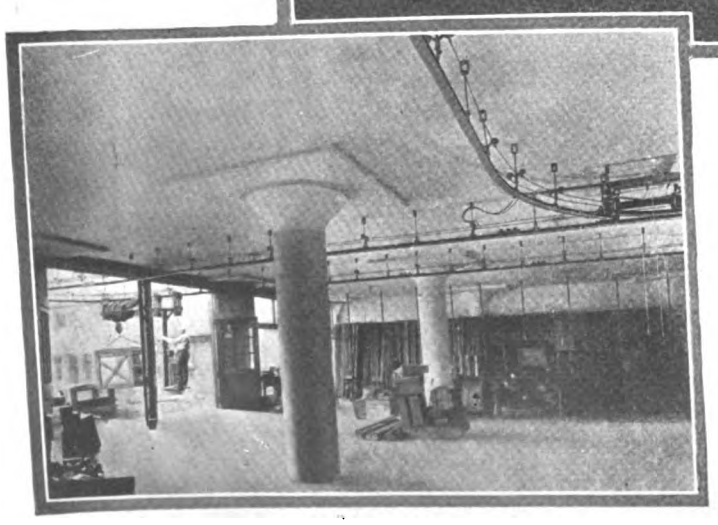
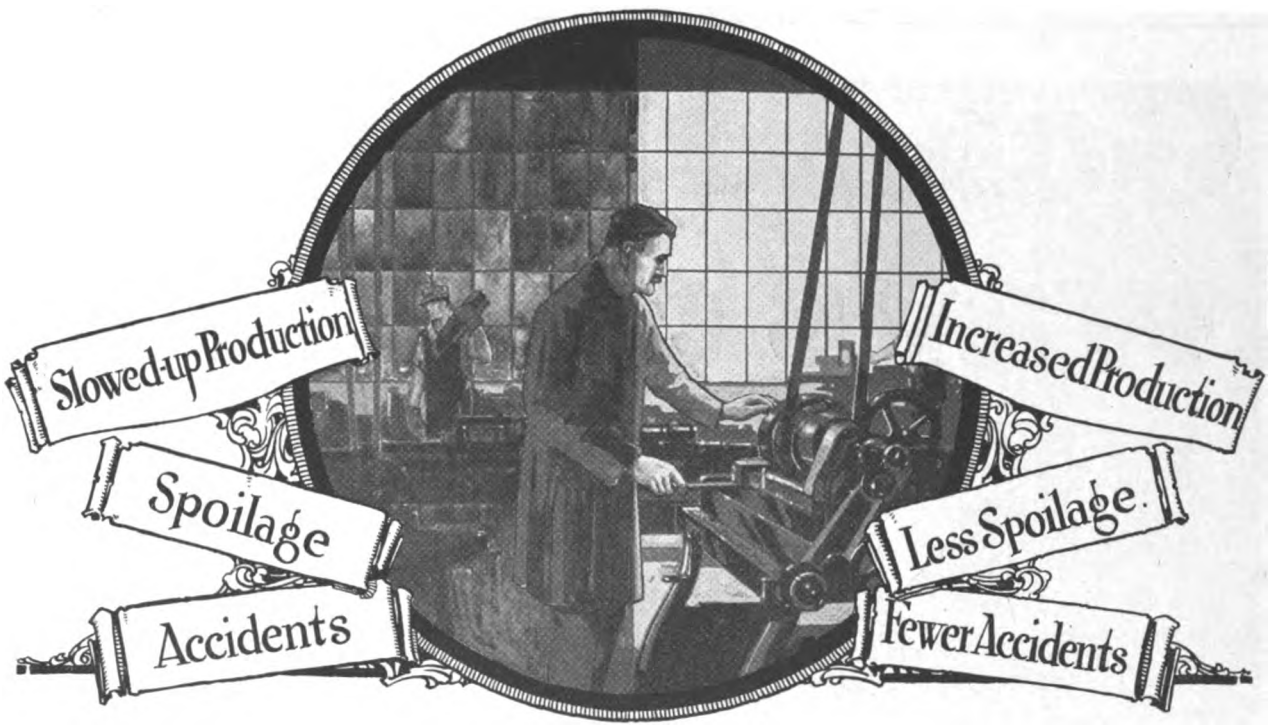


Fig. 4. Unloading an open truck and placing the material where wanted without rehandling.



Fig. 5. A large warehouse in Illinois, where ma... terials handling equipment means dollars and cents, plus better labor conditions.

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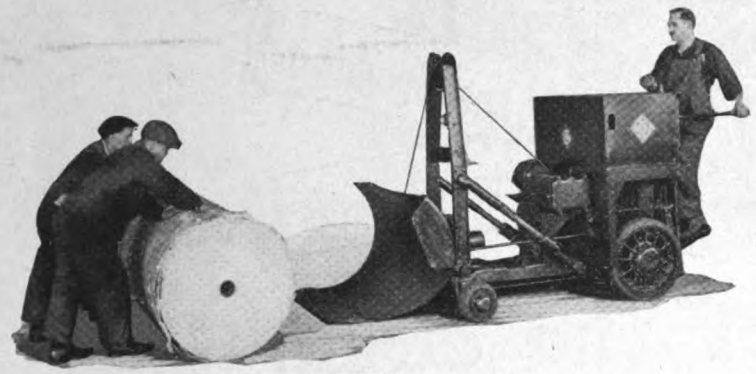
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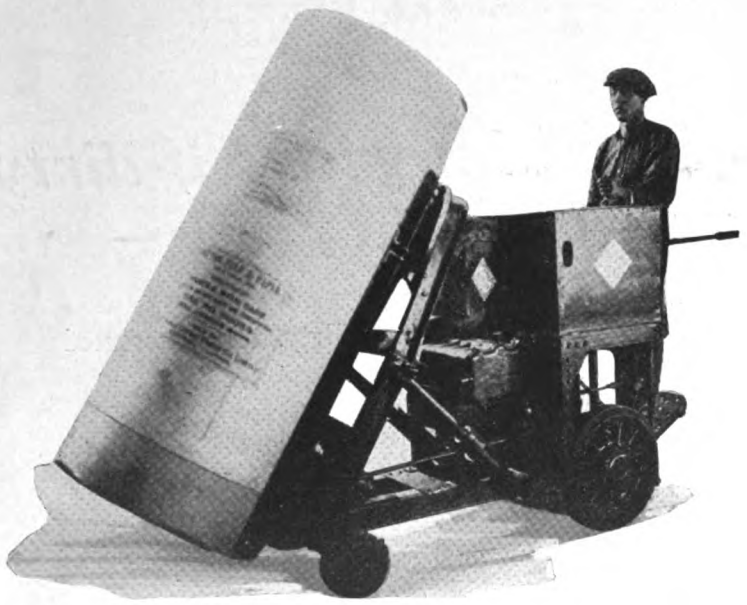
THE SKYBRYTE CO., KEITH BUILDING, CLEVELAND, OHIO
Chicago Branch, 20 East Jackson Boulevard

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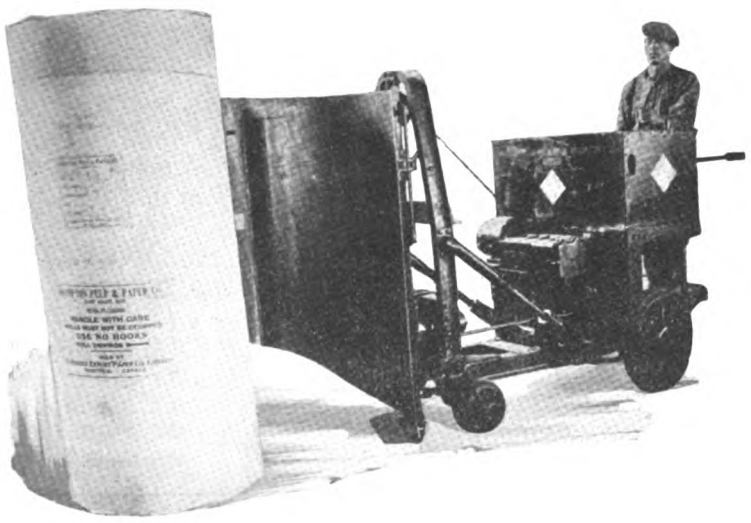
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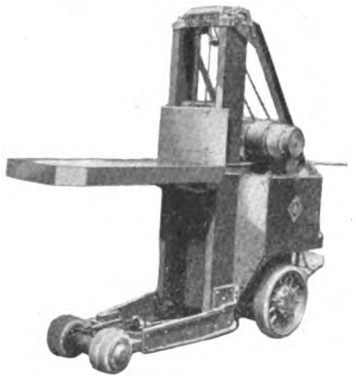
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And now—the Elwell-Parker

HI LO





JUST as husky and dependable as it *looks*, and just as good a performer as its name suggests—the Elwell-Parker "Hi-Lo" Tructor brings its owners all the strength, and reliability, and dependable operation that Elwell-Parker owners always expect—and get—

Plus a platform lifting range of 6 feet with a 3-ton load!

The Elwell-Parker "Hi-Lo" Tructor employs an entirely new principle of Hoist Drive. It has only two single straight running cables. Motor driven, double grooved, single drum hoist with oil immersed worm gear reduction. All moving parts are fully housed—none exposed. It has automatically-operated limit and interference stops; good clearances and ample battery capacity.

In the "Hi-Lo" Tructor, the rigid elevator uprights or ways are triply anchored to main frames. Large diameter, widely-spaced ball-bearing rollers support and guide the massive load decks—which are normally rated to electrically *pick up, carry and stack 6000 lbs.*

Elwell-Parker "Hi-Lo" Tructors are used similarly to the well-known electric industrial lift truck, except they elevate loads several feet instead of a few inches.

They are built with all-steel, low-hung frames, carried on sturdy broad gauge axles fitted with large rubber-tired wheels. *These tructors are equipped with larger batteries, motors, hoist units and bearings than any other machines of similar type.*

Request *your* copy of Bulletin 559.

The Elwell-Parker Electric Company
Cleveland, Ohio

Tructors

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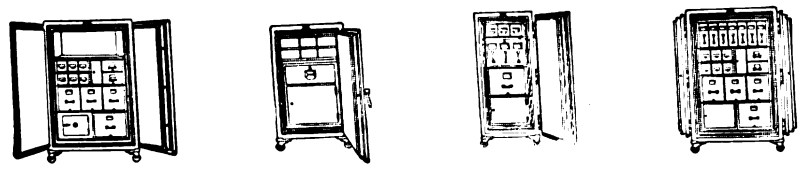
Too Late!

You Can't Save Records After the Fire Starts

Called out of bed, you learn that it's *your* office on fire! Too late to save anything. Yesterday's opportunity to protect valuables is gone. Whatever carelessness has been tolerated is going to be paid for now!

Tomorrow you must start business with whatever checks, inventories, orders, accounts, vouchers, mailing lists, production drawings, records the fire failed to reach. Those stuffed into desk drawers are gone. Those put into fire-protected safes are preserved.

Every man knows what he *ought* to do about providing adequate fire-safe storage. *Some* will do it *today*. Van Dorn Safes cost so little compared with the risks they prevent!



The interiors of Van Dorn Safes are easily arranged to accommodate any kind of material you want to protect from fire, dirt, mice and carelessness.

THE VAN DORN IRON WORKS COMPANY
CLEVELAND

Branch Offices:
New York, Chicago, Philadelphia
Washington, Pittsburgh, Cleveland

Van Dorn
MASTER CRAFTSMANSHIP IN STEEL

What Paint Means to Maintenance

(*Continued from page* 15)

other qualifications or characteristics which should be considered. Illumination is largely affected by the surface finish of the paint. All degrees of gloss varying from a flat to a very high gloss may be obtained. More or less gloss is obtained, by the manufacturer, by varying the proportions of pigment and binder. A flat white paint would be desirable from the reflection standpoint because it would diffuse any light that fell upon it without glare. However, unless one wishes to paint often, a gloss surface is more easily washed and is usually used in plant work. The degree of gloss should be determined by the conditions. A high gloss is not required in a room exposed to bright sunlight, but in a dark room it should be used.

Another very important point is the capacity for hiding the surface under the paint being applied. This covering power or degree of opacity as it is called, is very important. Most of us know that white enamels are applied over one or two coats of flat white because, in themselves, they do not have very much covering power. This same lack of covering power occurs in white paints, although to a much less degree than in the case of white enamels. Light reflection and opacity go hand in hand. Pigments such as white lead, zinc oxide and lithopone are largely used, either by themselves or in combination with others, and they make paints with a high degree of opacity. Some pigments will take more binder than others and this naturally has some effect on the opacity or transparency of various points. However, there is not much difference in the light reflecting qualities of any paint made with a good white pigment as a base.

A paint for plant use should be washable and durable, so that dust and dirt can be washed off at frequent intervals. There are flat finishes as well as gloss finishes which may be washed time after time without appreciably diminishing the value of the paint. In fact the washable feature is one of the most important in the list of qualifications. Cold water paints have good light reflecting qualities and are opaque, but they are not washable and of course are not permanent. Any paint to be really washable must be non-porous, so that the dirt will wash off, and not into, the paint. The sanitary value of this feature is of paramount importance, especially in plants where the dust may contain poisonous matter. A paint which will stand washings after being subjected to dust, mild fumes and moisture, may be considered durable. If it can stand all these attacks and not chip or flake, its durability is settled. Good materials properly mixed will stand all these tests and one should look for them when selecting paint.

Another important point to be taken into consideration in the selection of paint is its permanency or ability to stay white. Most pigments will retain their original whiteness, but many oils which are used for binders will yellow with age especially in a dark place. There are a great many paints now on the market, however, that will stay white for a long time. The paint manufacturers have ingeniously devised methods of overcoming the yellowing effect of aging on the oils or binders and are now producing white paints that stay white.

It is quite important that the paint film should be elastic. Checking will be avoided if the film is elastic, and it is well to have both coats of approximately the same consistency so they will be less liable to checking.

Another factor which enters into the selection of paint is the ease with which it can be worked. A paint which is easily worked allows a man to apply more in a day, and in this way it is apparent that the cheapest paint is not always the most economical in the long run. Closely allied with this quality of workability, is the area which can be well covered per gallon. This is a very important point and if a large amount of work is to be done, it may be advisable to make tests. A narrow strip three or four feet wide should be painted with a like amount of the various samples to be tested, and the length of time consumed in applying, and the number of square feet covered, should be recorded. It is then possible to figure out which paint is the most economical, based on the cost of material and labor, per square foot on the wall. A test of this kind, in order to be fairly made, should be prepared for in advance, so that the painter who applies the paint will not know

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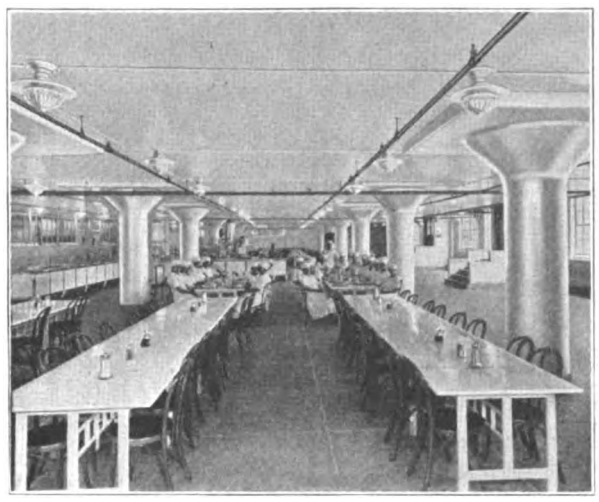
is which. Plain cans be numbered and the s poured into them. The ty should be carefully red, and each sample be applied with a new

ood white paint should not yellow with age. We ex- that of any good paint lays, and it is probable few of us appreciate the nt of research work in stry, which is necessary p improving standards, as ve improved them in the few years. With this im- ment there has also come eat improvement in the ods of making paint, and modern paint plants of to- are very efficiently man-

lls and ceilings should be ed regularly. No set time his work can be mentioned as each individual plant different conditions. As a al rule, machine shops and departments where dust dirt alone darken the walls, should be washed down at every year, and preferably y six months. Painting ld be done every two or e years at the most. It isn't ssary to shut down a depart- t to paint, as this work can lone overnight and over a k-end. However, it is usu- possible to paint walls and mns during working hours, ing only the ceiling to be e overtime. Oftentimes it is sible to move through a n, doing two or three bays time, and moving any oper- s in the bays being worked nto another bay for the day. s a well known fact that a n, well-painted factory tends ut down the fire risk. Men more careful if things are n and orderly. The lower t of walls and columns is usu- painted with a dark color that dirty finger marks will show. This is called a dado. ing a tougher film it does not ow marks from being scuffed trucks or work boxes as much a white wall. The tendency ems to be to use lighter colors the dado than formerly, in der to get the benefit of the tter light reflection, and also it tends to make the men less ble to expectorate in the cor- rs.

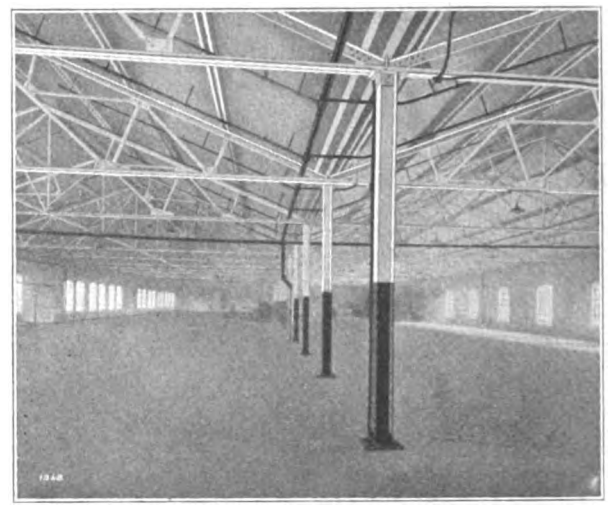
It is assumed that in mainte- nce work, most of the painting ll be on surfaces already inted with some kind of oil int. However, some work may have to be done on new surfaces, or on surfaces previously covered with water paint or kalsomine. These two materials should be washed or scraped off, before applying any oil paint. If the first coat is thin enough to penetrate and make a good bond, no sizing should be necessary. The first coat should overcome the action of the lime in plaster or cement, either by neutralizing, or sealing up the pores. If the walls are in bad condition the spots should be patched up before the painters start. For small spots in plastered walls, plaster Paris can be used, and on cement walls a neat cement paste with a small amount of fine sand can be used.

No paint can be expected to stick to a damp wall or ceiling. Be sure your walls are dry before starting to paint. The dust should be brushed off, or washed off a day before, to allow the surface to dry. For two-coat work on previously painted walls each coat should be fairly thin, so as not to get too heavy a coating. If the coats are of the same elasticity, they will ex-



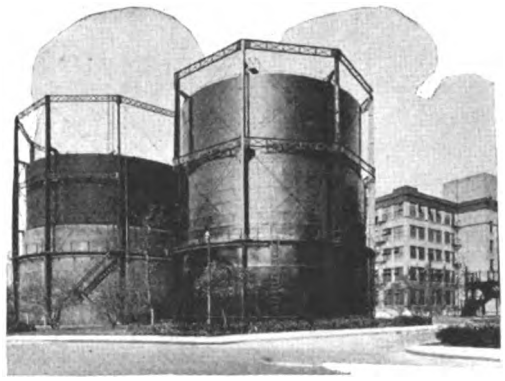
Mishawaka Rubber & Woolen Mfg. Co., Mishawaka, Ind.

60 barrels **Industrial White** *used for daylighting interior of entire plant, decided increase of lighting efficiency and economy of lighting. All exterior concrete damp-proofed with* **Stonetex.**



Kalamazoo Paper Co., Kalamazoo, Mich.

Cement floors hardened with **Agatex**—*Interior daylighted with* **Industrial White**—*Basements waterproofed with Truscon* **Waterproofing Paste**—**Fibrotex** *Handy Leak-proofing material for roofs, eaves, skylights*—**Waterproof House Paint** *for exterior wood painting.*



Western Electric Co., Chicago, Ill.

All exposed steel, gas-holders as well as other structurals, protected with **Bar-Ox Inhibitive Steel Paint**—**Stonetex** *for protecting concrete and masonry*—**Metal Sash Putty** *for steel sash.*



Continental Motors Corp., Muskegon, Mich.

Skylight and Window Cleaner *for keeping windows clear of rust and grime*—**Bar-Ox** *for protecting steel sash and structurals*—**Stonetex** *for damp-proofings exposed masonry and concrete*—**Agatex** *chemical hardener for cement floors*—**Fibrotex** *Handy Leak-proofer.*



Fisher Body Ohio Co., Cleveland, Ohio.

Stonetex *for brightening all exposed concrete and preventing disintegration—Basements water-tight with Truscon* **Waterproofing Paste**—**Pipe Identification Paint**—**Radiator Flat.**

A Complete Maintenance Service

From basement to flagpole—from elevator pit to roof—interiors and exteriors—for steel, wood, concrete, brick or stone—Truscon Maintenance Service is complete throughout.

Basements are waterproofed—concrete floors hardened—interiors brightened to cut down electric light bills—roofs kept waterproof—and the whole building, whether factory, office, hospital or public building, kept in spick-and-span, up-to-the-minute condition.

Such is Truscon Maintenance Service. It is the outgrowth of years of work in the Maintenance field. No other organization has the equipment, the technical training or the experience to vie with it. A thousand manufacturing plants are using it every day in one phase or another.

If you have a maintenance problem that has been giving you worry or trouble, put it up to the Truscon Maintenance Engineering organization. It may be you require a special acid-resistant paint for protecting structural steel in a plating plant—it may be a non-yellowing mill white for a rubber plant—or a special production transparent waterproof varnish—an alkali-proof paint, etc. Problems like these are daily presented to the Truscon Maintenance organization for solution. What seems difficult to you, we may have solved previously for others. Consultation costs nothing and puts you under no obligation.

Ask for the Truscon Maintenance Chart.

THE TRUSCON LABORATORIES
Detroit, Michigan.

Branches: New York, Chicago, Philadelphia, Atlanta and 24 other principal cities.

Gentlemen:

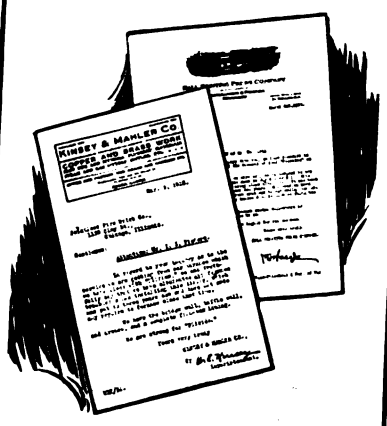
☐ Please send us the Truscon Maintenance Chart.
☐ Give us information on the following Maintenance problem. (Described in letter attached.)

Company..... Official.....
Address .....
City and State.....

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Applying Plibrico



The story that many users tell:

"Our 3-year old Plibrico Lining is still good"

IN a month, five letters were received telling of Plibrico-lined furnaces that had been in continuous service for over three years—and that were still going strong. They are typical of many letters that tell of two, three and even four years' service without relining. They came from:

Hall Prtg. Press Co., Dunellen, N. J.
Kinsey & Maller, Peoria
Thomas Dye Works, San Francisco
Gulf Coast Mch. & Sup. Co., Beaumont, Tex.
Smith & Wyman, Minneapolis

Do you get two to four years' service from fire brick linings? If you don't you need the new handbook, "Refractories and Furnace Design," that tells how jointless linings last longer, cut down heat loss and are installed by unskilled labor. Send the coupon below.

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Warehouse stocks in 60 cities—see the phone book.

PLIBRICO
FURNACE LINING
REG. U. S. PAT. OFF.
JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

The coupon brings this **FREE***book*



Jointless Fire Brick Co., Ind.
1154 Clay St., Chicago. Ill.
1-24

Please send me the 32 page booklet "Refractories and Furnace Design"—no obligation.

Firm .....

Address .....

.....

.....

pand and contract evenly, preventing cracking of the face. If there are spots w the suction was bad on pre coats, touch them up b starting, so as to make a job. On new concrete which are smoothed up wi cement wash, the first should be thinned more usual in order that it will p trate. The next coat shoul a little heavier in order to c well. New concrete walls o require a preliminary treatn to get good results, especiall free lime is present. A di zinc sulphate solution is of used for this purpose and if lowed to become thoroughly d most paint will stick to it. spots on walls or ceilings usual where high speed belts present. These spots should cleaned by washing with b zine before painting. If a hi gloss paint is already on t wall, it may be necessary sandpaper it a little to rough the surface, so the new pai will stick. After sandpaperin the surface should be wiped remove the dust.

Walls of hollow tile are ha to paint, whether of plain hc low tile or plastered over th tile. These are largely used fc fireproof partitions in concret buildings. They are apt to hav more suction than any othe wall, and therefore the amoun of thinner used will have to b doubled in some cases. Brick walls, especially of soft brick are also apt to have a great dea of suction and will require about the same treatment as hol low tile. Metal ceilings are occasionally met with in wooden buildings in some plants. If they have been previously painted the new paint will stick well if the surface is clean. Any rusty spots should be wire-brushed clean, and these spots touched up before starting. Stains on ceilings can be overcome sometimes by a coat or two of a metal paint such as aluminum paint. In a great many cases this will prevent stains from coming through. This same method can be used on concrete, plaster or wooden ceilings.

For large areas, and especially on new building work, the spray method of painting is now being extensively used. For interior work on new buildings it is being used with success. It is necessary to have windows open to carry off the volatile fumes released while spraying. For

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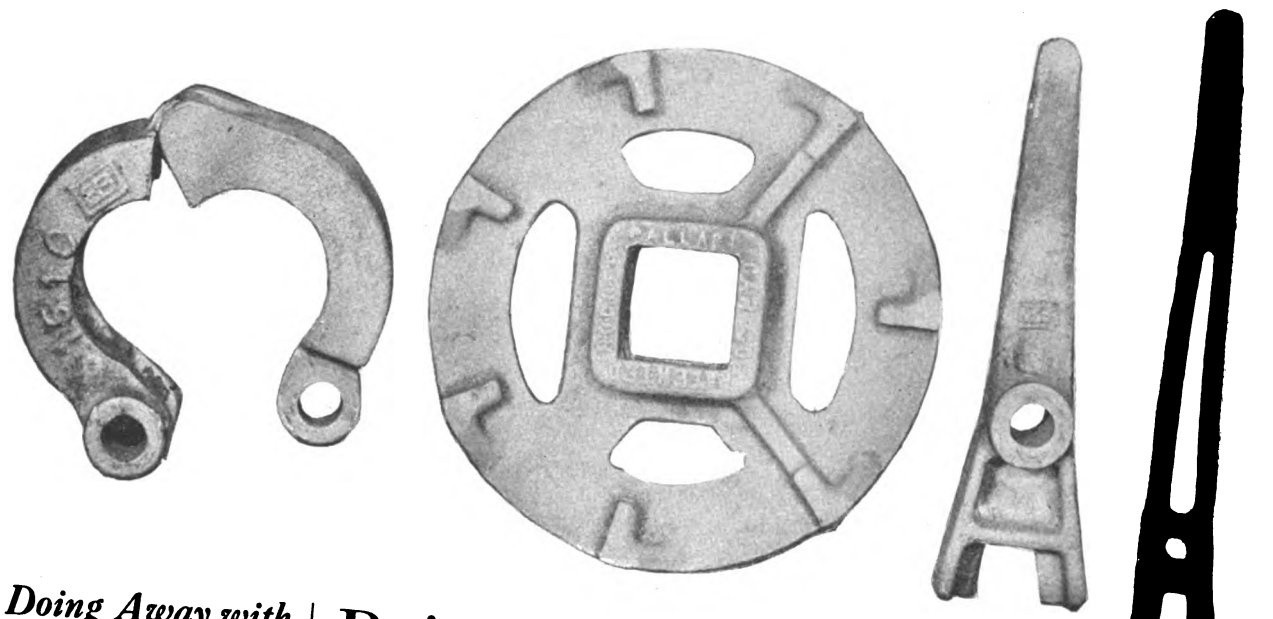
interior work where equipment is installed in the room, it is necessary to cover all the equipment quite well with drop cloths. In most cases spray painting requires ten to thirty per cent. more paint than the hand method. On the other hand, the hand method requires two or three times the amount of labor required by the spray method. The men using the spray inside a building should wear a respirator to absorb the volatile vapors and catch the small particles of pigment floating in the air. Naturally the introduction of this method of painting has met with a certain amount of resistance from the painters, and in some cases it is necessary to train new men in the use of this equipment. There are certainly a great many places, which otherwise would not be painted by hand, which can be easily sprayed, and in this way preserved. Tanks and other large blank areas can be easily painted by this method. When the spray is used out of doors the volatile vapors are carried away by the wind, and this method is very well suited for this work.

Concrete floors which are exposed to heavy wear may dust, in which case they may be hardened or painted. There are various kinds of hardeners on the market which give good results. Water solutions of sodium silicate have been used with considerable success as hardeners. Floors hardened in this way can be painted later on if desired. On basement or ground floors, where the concrete is laid on a cinder fill, there are apt to be alkali conditions present which can be neutralized with a water solution of acetic acid, to which a little alum and blue vitriol have been added. This should be brushed onto the floor and allowed to dry, after which the floor may be painted. Most floor paints are made with a pigment which resists wear and a hard resin varnish.

This makes a surface which resists wear and improves the surface. Most good floor paints are not affected by oil, water or grease, and therefore protect the ceiling below from oil stains. Wooden floors may be painted with a preservative to lengthen their life. This is best done while the floor is comparatively new and before it is rutted or chewed up. Trucking aisles should be painted with a white line about three inches broad. This line acts as a dead line, outside of which no one is allowed to pile goods. It is surprising how much time is lost in the average plant by truckers who cannot pass one another without pulling out of the way. Painted trucking aisles may seem to some folks to be a waste of good piling space, but they tend to make an orderly plant and certainly save time in moving materials.

Where pipes are painted with different colors to identify them, it is easy to find them in an emergency. This is especially true of sprinkler and ammonia pipes. Sprinkler pipes have been painted red for a good many years, but the use of colors on the others, such as ammonia, compressed air, steam, water, oil gas, hydraulic and drain pipes, is a practice which is gradually being introduced into all plants of any size. A set of standard colors should be adopted at the outset. Most paint manufacturers have a standard set. Pipes covered with asphalt, such as soil or drain pipes, are some-

(*Continued on page 37*)



Doing Away with One of the Principal Causes of Defective Castings

Shop defectives, that is, castings rejected by the foundry inspectors, are a heavy item in foundry costs.

One of the principal causes of shop defectives is the shifting of cores.

Thorough analysis of the experience of the Nugent Steel Castings Company and that of a number of other steel foundries shows that shifting is much more common when stock cores are used than when special cores are made for each pattern.

This, of course, requires excellent core making equipment in the foundry.

How this has been provided by the Nugent Steel Castings Company is described in one of our bulletins.

Rejections $\frac{735}{100,000}$ of 1%

During the last twenty-two months we have furnished a certain customer 1,050 tons of castings comprising 81,588 separate pieces. During that period the customer has returned to us as defective a total of 6 pieces. The percentage of defectives is, therefore, 735/100,000 of 1%—a percentage so small that it indicates a truly phenomenal foundry efficiency.

This D series of bulletins will be sent free to anyone requesting it on business stationery.

NUGENT STEEL CASTINGS COMPANY
formerly ELECTRIC STEEL COMPANY
31st and Wood Sts., CHICAGO

NUGENT STEEL

NS

Reducing Castings Inventories with Better Delivery Service

Many purchasers of steel castings frequently overlook one outstanding advantage that can be gained by buying from a properly organized and favorably located foundry such as the Nugent Steel Castings Company. That advantage is the saving that can be made by keeping down inventory.

One of our out-of-town customers has found during the past year that our ability to deliver with uniform regularity and on short notice has enabled him to reduce his monthly inventory of castings by $30,000. Excellent deliveries freed him from the necessity of anticipating his requirements by carrying large stocks.

WE SPECIALIZE IN THE PRODUCTION OF INTRICATE AND THIN SECTION CASTINGS

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The Turn Table that Solved a Foundry Production Problem



Showing the construction of the Easton Turn Table, specially constructed for the above installation

Comparing the modern foundry to its prototype of a few years back is like comparing the present system of industrial conveying and handling machinery to the old and costly system of wheelbarrow transportation.

In the foundry as in every other branch of industry great strides toward continuous production have been made and it has been among our experiences to aid in the design and installation of a turn table for two electric furnaces, which made possible continuous operation and the lowering of production costs.

In this installation only one set of electrodes and electrical equipment is made necessary. And through the use of the turn table one charge can be poured while the other furnace is undergoing repairs and cleaning. Thus the turn table is not only an aid to continuous operation but also saves the great expense of one set of electric equipment.

This installation is but another example of the diversified character of our work and the extent of our ability and experience.

You may have a handling problem which requires special applications and plans. Our engineers stand ready to give you the benefit of the experience gained on thousands of installations.

EASTON CAR & CONSTRUCTION CO.

EASTON, PA.

SALES OFFICES

Hudson Terminal, New York
Morris Building, Philadelphia
Kunkel Building, Harrisburg

Jefferson Building, Birmingham
Oliver Building, Pittsburgh
McKevitt Building, Norfolk

EASTON CARS

FOR EVERY INDUSTRIAL PURPOSE

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(*Continued from page* 35)

times hard to paint. A good way to overcome this trouble is to put on two coats of aluminum paint. This will hold in the asphalt, and the pipe can then be painted in the usual way. Pipe coil radiation in the plant is usually painted the same color as the dado or black. Most of the dado colors will not change color when subjected to the heat in a pipe coil radiator, and are therefore all right to use. In fact, the practice of painting office cast iron radiators with aluminum paint or bronze paint is being given up by those who claim that oil paint is better because it has a higher radiating efficiency.

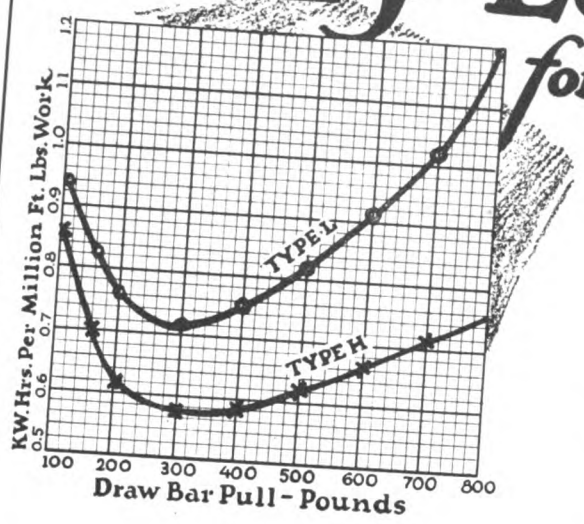
The use of special paints for special purposes is gradually becoming more prevalent in plant maintenance painting. For each particular surface there is a paint which is best. It is evident that a paint which is good for steel work would not stand up on a boiler front or a hot flue or stack. Metal surfaces, subject to air with moisture, are very much subject to corrosion, and this is very greatly speeded up by the presence in the air of sulphur and soot, such as we get in the air of most cities. A great deal of corrosion can be avoided by proper painting. Steel or iron surfaces which have been rusted should be brushed with wire brushes and scraped with chisels if necessary to get down to the steel. A priming coat containing one or more of the basic or chromate pigments followed by a coat of carbon or iron oxide paint will protect steel or iron from corrosion for a long time if the conditions are average. For special conditions, however, some other treatment may be better.

The time is coming when all machines, instead of being painted in the usual black or very dark colors, will be painted light gray or some other light color. Most operators will take pride in their machines if the management will lead the way by improving the appearance of the machines. From the standpoint of lighting, both by daylight and artificial, it is evident that light colors on machinery will reflect more light and actually save money on lighting bills. Bench legs and all other stands and movable equipment may also be painted the same color as the machinery.

Tin roofs require frequent inspection and touching up. If rusty in spots, the surface should be wire brushed and given a priming coat of red lead and a coat of any good roof paint. If repairs are required on any of the built-up types of roofing, a thin elastic cement paint can be used. Glazing is usually done by the painters. Lighting by daylight can often be diffused to a better degree by the use of prism type glass. This glass tends to bend the light rays into the middle of the room and will help a great deal in a room which is dark a short distance back from the windows. The inside of steel sash, as well as a great many other metal surfaces inside the plant, can be painted with the wall paint. However, the outside of the steel sash should be painted with a metal protective paint as noted above. Steel work, such as fire escapes, skylights and ventilators, exposed to the weather, also require metal protective paints, as noted above in the treatment of steel and iron surfaces. The steel work on bridges, as well as the corrugated iron covering,

(*Continued on page* 39)

Use 25% Less Electricity for the Same Work



THE design of an electric tractor determines how many kilowatt hours of electricity you must put into that tractor's batteries to do your work.

The new Mercury Type H requires 20% to 40% less energy than the best of the worm driven models. Look at the accompanying curves showing this saving in kilowatt hours for various draw-bar pulls.

This means that you can charge the batteries in a Type H tractor at a lower rate, or for a shorter period, or at greater intervals. Any way you fix it, you save 20% to 40% on power bills for your industrial hauling.

How The New Type-H Makes This Possible

Introduces a balanced internal gear drive of entirely new design, eliminating the friction losses inherent in the worm drive. This results both in low operating cost and an absolute minimum of upkeep for the "power plant."

Retains all valuable features developed in previous Mercury models including:

1 Special safety features effectively insuring against danger, even in the hands of inexperienced workmen.

2 Drum type controller of special design having long life, dependability, simplicity, ease of inspection and adjustment.

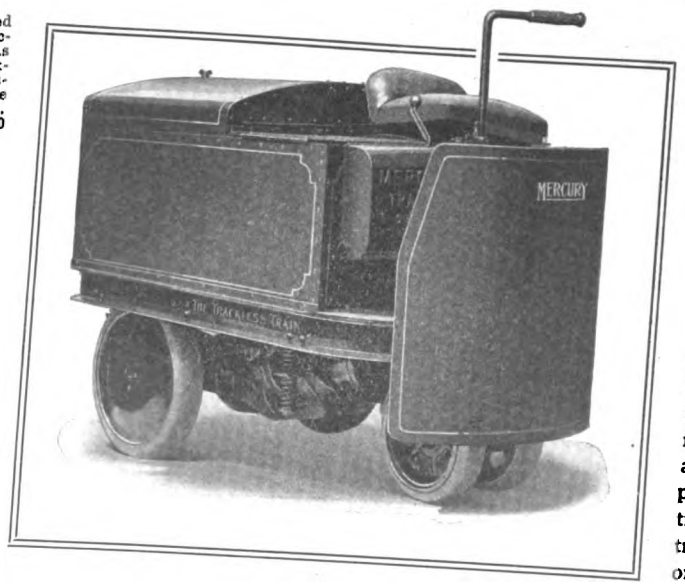
3 The exclusive Twin-3 front wheel assembly combining full spring suspension with the short turning radius of older 3-wheel models.

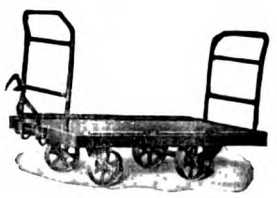
4 Frame of channels and angles hot riveted to combine maximum simplicity, rigidity and strength.

Fleet Owners

The Mercury organization pioneered in the field of electric industrial tractors, and for more than 8 years has made such tractors and trailers exclusively. It is therefore not surprising that a preponderance of all the large installations are 100% Mercury. A few of the large fleet users (over 10 machines) are the following:

American Railway Express Co.
American Radiator Co.
Armour & Co.
American Window Glass Co.
General Electric Co.
Endicott-Johnson Co.
United States Government
Studebaker Corporation
Sugimure Warehouse (Japan)
Willys-Overland Co.
United States Government
American Car & Foundry Co.
Kewanee Boiler Co.
Eastman, Gardiner Lumber Co.
Standard Oil Co.
Union Stock Yards & Transit Co.
Pennsylvania Railroad Co.
Sears, Roebuck & Co.
Illinois Central Railroad
Lehon Co.
Morris & Co.
Swift & Co.
Miller Rubber Co.
Chicago Tunnel Co.
Chicago Union Station Co.
Chicago Burlington & Quincy R.R.
New York Central System





Trailers

And to complete the "Trackless Train" there are Mercury trailers of just as distinctive merit as the tractor. There are various designs for special purposes, but the A-310, illustrated above, is an all-purpose trailer which meets most all ordinary industrial conditions.

Mercury Manufacturing Company



4112 South Halsted Street — *Chicago, U. S. A*

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NILES CRANES



Speeding Up Uncle Sam's Mail

THIS 40-ton Niles Gantry Crane installed in the New York yards of a large Eastern Railroad handles mail and freight from cars to trucks in *half the time* formerly required.

Since speed, ease of handling and absolute reliability are main requirements for the crane doing this work the Niles Crane was selected.

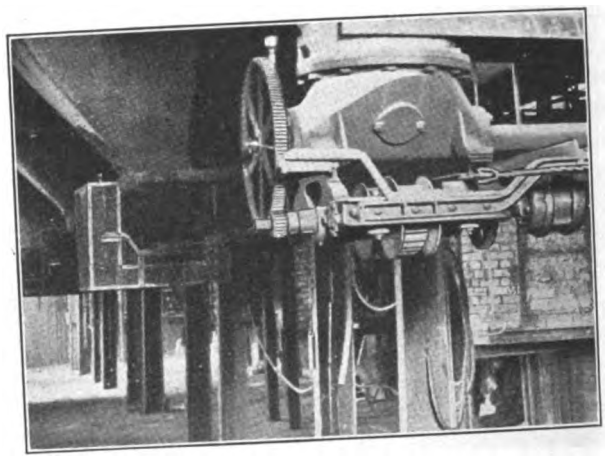
We build Niles Cranes in Electric Traveling, Jib and Wall types up to 200 tons size and larger. Our engineers will be glad to advise you in any of your transportation difficulties.

NILES CRANES
For the Steel Mill, Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy material must be handled with speed, safety and economy.

NILES-BEMENT-POND CO.
111 BROADWAY—NEW YORK CITY
CRANE WORKS— PHILADELPHIA, PA.

No. 9 *of a series illustrating the many industries served by Niles Cranes.*

Courtesy of Raymond Bros. Engineering Co., Chicago, Installations of 8 No. O-D Reeves Transmission, Illinois Malleable Iron Co.

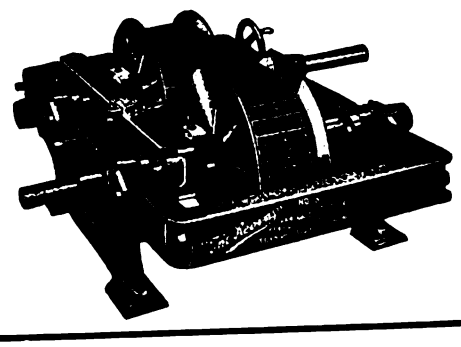


"The Reeves"

VARIABLE SPEED TRANSMISSION

INFINITE SPEED VARIATION
Easily and quickly obtained

Simple to operate. Inexpensive to maintain. Reduces cost to such an extent that it pays for itself in a very short time.



"THE REEVES" Variable Speed Transmission, as now manufactured, represents the most perfect mechanism procurable for the purpose of transmitting VARIABLE SPEEDS.

Its appeal to users is based solely on its ability to not only save money but to increase production and improve the quality of his goods.

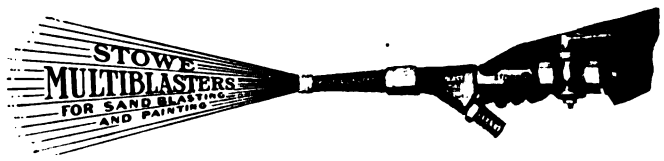
The eight annealing ovens shown above cut, formerly required a man at each furnace, as well as a complement of coal passers to maintain the proper heat. Since the adoption of "The Reeves" Transmissions on the new pulverize coal system, one tender and his assistant now operate the entire battery.

Write for 52 page illustrated catalog, L-44.

REEVES PULLEY COMPANY
Columbus, Indiana

A **Sand Blast** as Powerful and Durable as the most costly at **$30.00**

A **Paint Spray** that leads in Economy, Durability and Efficiency at **$12.00**



STOWE MULTIBLASTERS (both sandblast and paint spray) sell at the lowest price on the market. But in effectiveness, adaptability and money saving qualities, they are leaders in their line.

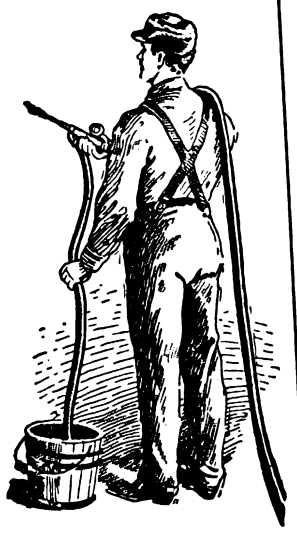
One man with a MULTIBLASTER can do the work of a gang of six at either sandblasting or painting and do it better. The MULTIBLASTER affords uniform distribution of the sand or paint which is drawn into the spray by suction.

ALL MULTIBLASTERS are portable, require no installation of tanks and can be used anywhere. Sand is syphoned from pit, barrel or pile—paint from any container. Compressed air does the work.

Our 10 Day Trial Offer

will enable you to prove the value and superiority of the MULTIBLASTER before you actually buy it. We will send you any outfit listed below, ready to attach to your airlines for 10 days' free trial. Write for yours today.

	Price	Weight lbs.	Hose Suction In.	Pressure lbs.
Standard Size Sand Blast	$30.00	8	1	80-90
Medium Size Sand Blast	18.00	6	¾	60-70
Bench Size Sand Blast	15.00	3	½	40-50
Paint Spray	12.00	2	½	40-50



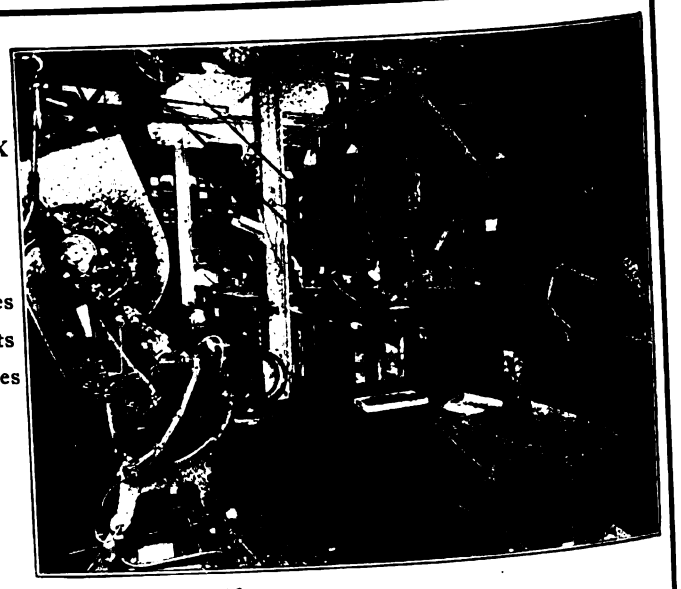
"The Man Behind the Gun"
(COPYRIGHTED)

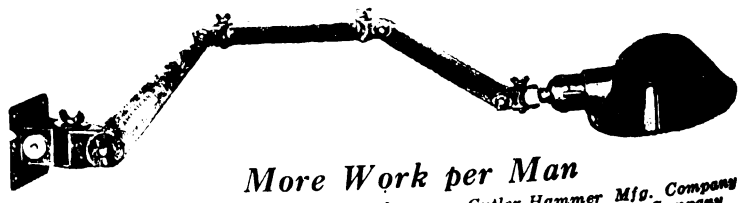
Geo. M. Stowe, Jr.
MANUFACTURER
68 Forest Avenue Buffalo, N. Y.

STOWE MULTIBLASTER

MADE IN SIX STYLES

- Ceiling Fixtures
- Floor Fixtures
- Wall Brackets
- Bench Fixtures
- Machine Fixtures
- Portables





More Work per Man

That's just exactly what "American" Adjustable Fixtures will do for you—are doing right now in such large concerns as

Allis-Chalmers Mfg. Company
Phoenix Knitting Mills
National Lamp Works
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The light will "stay put" regardless of vibration—on work bench or stamping machine, the operator's light is held firmly, free from glare and eye-strain, right on the job in hand. The patented Universal joints take care of that.

AMERICAN FIXTURE COMPANY, 230 West Water St.
MILWAUKEE WISCONSIN

Drop us a line today for prices

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(Continued from page 37)

the same treatment. nks and their structural pports are another item under the treatment for d iron surfaces.

rior concrete, which was l rammed and finished at e of construction, is apt e up moisture during rms, causing dampness in alls. A concrete paint will protect against the r will prove a paying in- nt, as sooner or later the re and consequent frost in will disintegrate the te and cause lumps to off. Most concrete paints a color nearly like the of the concrete itself and hould be of such a compo- that the action of free alkali in the concrete will ect them. Exterior paint- n usually be most economi- lone from a swing staging from the roof. However, ow buildings, a built-up g may be best. There are market portable stagings can be erected and taken any number of times. interior painting in the with twelve or fourteen- ceiling heights, the usual g horses provide an econ- al method of staging.

eds, fences, hydrant houses, other outdoor surfaces d be painted with a good her resisting paint. The lo- n of fire boxes and appara- an be more readily seen if d red spots are painted on walls. Numbers on build- are also more conspicuous hey are made with white ciled numbers on round k spots. These spots need nly eighteen inches in diam- , but the red spots for fire aratus should be at least e feet in diameter.

ust and decay will soon cost e by requiring replacement original materials than the t of maintenance painting. ere is no question but that intenance painting pays, and a plant having quite a large a, one or more painters work- all the year round is the st economical method. Out- e work can be done in good ather, and the men trans- red to inside jobs during ny weather. A painting de- rtment should have covered ns for rags and waste, and the or should be kept clean to oid fire danger. Large sup- ies of paints, oils, and thinners ay be kept in the fireproof oil storage room and drawn on requisition in small quantities every few days, and kept in tightly covered tanks or cans. Supplies such as brushes should be kept in the stockroom and issued as needed.

A yearly inspection of the entire plant is the best method of finding places where rust or decay are starting. These surfaces can then be painted, and in this way expensive replacement is not needed. To be of the most value, this yearly inspection should be made by someone who is acquainted with the work, so that he can make valuable suggestions. A record of this kind over a number of years will be of invaluable assistance in picking the kind of materials best suited to the individual jobs.

Even at the risk of being tiresome, it is worth-while to call attention to the old adage about "a stitch in time." Delay in painting does not merely mean postponement—often the surface which *should* have been painted, has passed beyond the stage where paint would save it.



Where the Facts Came From

You may want the facts that form the basis of this dramatized incident. We can give you, on request, information on many installations where savings several times as great have been effected. In one case a western manufacturer was able to discard three of his four boiler plants after his *Grinnell forced circulation hot water heating system* was installed. The booklet, "Five Factors in Heating Cost," will be sent to any one interested in heating industrial buildings. Send for a copy today. Address Grinnell Company, Inc., 307 W. Exchange St., Providence, R. I.

Have you a Bolshevik like this in your plant?

President: "Jim Carney—impossible! I'd as soon suspect myself of being a Red. Why, he started with us in the old works on River Street. We were planning to retire him on a tidy pension in July."

Production Manager: "I wouldn't believe it myself, but how do you explain this? As foreman he has always just lived in his own department. Lately he's been hanging around the engine room a lot. Never used to miss a day. Lately, he's been off constantly and yesterday we saw him go into the building in which a group of radicals has offices. Last night, with the thermometer below zero, the watchman saw him out behind the boiler house. Thought he saw the glint of a pistol. But this morning when we searched his overcoat all we found was a steel tape line."

Chief Engineer: "And last Thursday my assistant found him behind the separator examining the exhaust pipe vent in the wall. He told me that it would be simple to move a charge of dynamite in from the outside and blow the engine room to pieces."

President: "But what does Jim say?"

Production Manager: "That's the worst of it. He won't talk. Seems abstracted. When he left this afternoon all he said was that if anything special came up he could be reached at Main 761. It's up to you or the police department to wring the truth out of him."

President: "Main 761—why that's our Consulting Engineer's number. I'll call him right up."

* * * * * *

Half an hour later the Consulting Engineer and Jim Carney entered the President's office.

"Well, Jim," said the President, "what are you up to now?"

"It's that pension, sir," stammered Jim, "I——"

"Perhaps I'd better explain," smiled the Consulting Engineer. "I'm afraid Jim's a little too modest. About a month ago he came to me and said he had heard he was going to be pensioned off. Before he went he wanted to do something big for that $600 a year."

"Something big—what do you mean?" cut in the President.

"It seems your old Superintendent Swanson turned him down pretty hard on a proposition he submitted and Jim said he didn't want to bring it up again until he had all the facts. I saw he was on a big thing and I agreed to keep it quiet and help him work it out. You see it was all in appreciation of what the firm was going to do for him. The figures came in today and I had just told him before you called up that in return for his $600 pension, he was presenting you, his chief, with a pension of $5,000 a year as long as your business lasts."

President: "You're joking—why, it's preposterous!"

Consulting Engineer: "Not at all. Jim read a Grinnell advertisement about heating a plant with exhaust steam. Didn't know how, you understand, but he stuck to the idea and collected the data we needed for——"

Production Manager: "But $5,000 a year, that's the cost of our whole year's heating!"

Consulting Engineer: "Right! Grinnell Company, whom I always depend on for such special systems, finds that the exhaust steam from the generating plant will run a hot water heating system and save the entire fuel bill—$5,000 a year. That's what Jim's been doing."

Production Manager: "That explains a lot."

President: "Jim, old man, I told them you couldn't—why, old boy—why, Jim——."

GRINNELL COMPANY

Automatic Sprinkler Systems | Steam & Hot Water Heating Equipment | Humidifying and Drying Equipment | Fittings, Hangers and Valves | Pipe Bending, Welding, etc. | Power and Process Piping

If it's Industrial Piping, take it up with us

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Tom Jones, operator, is wasting your money

IT isn't his fault. You require him to keep the time of the various job lots which pass through his machine. It is a job that he was never trained for—and of course he makes mistakes. He guesses to the best of his ability and that is as good as you can expect.

A Calculagraph on the other hand would stamp on each job ticket the starting, stopping and *elapsed time*. There could be no errors, for all calculations would be mechanical. Your cost records would be accurate and you would save the time of operators who were never meant to be time clerks.

Write today for our booklet "ELAPSED TIME RECORDS." It describes the Calculagraph and its application to your business.

The Calculagraph Company

34 Church Street — New York



The Calculagraph is being used successfully in the following industries

Aluminum Wear
Ammunition, Guns, etc.
Auto Accessories
Auto Painting, etc.
Automobiles, (Motors & Bodies)
Bolts and Nuts
Brass Goods
Brushes
Candy Mfrs.
Cans
Carpets and Oilcloths
Chairs
Chemists
Clothing
Colleges and Universities
Contractors
Copper Goods
Department Stores
Electrical Appliances & Supplies
Engines
Flour Mills
Foundries
Fountain Pens
Furnaces, Stoves, Ranges
Furniture
Garages
Hardware
Heating Apparatus
Inks
Japanese Goods
Jewelers, Silversmiths
Knitting Mills
Laces
Lamps
Lanterns
Leather
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Machinery, Iron & Sheet Metal Workers, etc.
Metal Furniture
Mining
Optical Goods
Paper
Pianos and Organs
Plumbers' Supplies
Power Houses
Printers, Publishers, etc.
Private P.B.X.
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Pumps
Radio
Railroads and Supplies
Refrigerators
Rolling Chairs
Roofing Supplies
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Scientific Instruments
Shade Rollers
Shirts and Collars
Shoes
Shipbuilding
Smokers' Articles
Soap
Sporting Goods
Steel & Wire, Wire Rope, etc.
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Stoves
Tailors
Textiles
Truck Deliveries
Undertakers' Supplies
Uniforms
Women's Wear
Woodworkers
X-Ray Equipment

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Planning the New Building

(*Continued from page* 11)

veals a more continuous and steady development in the field of machinery and labor saving devices than it does in the development of the factory building and its equipment. For a long time little thought was given to the plan and design of the building, and the principal concern for these seems to have been to provide the four walls and a roof to house the new machinery. It was probably only about twenty years ago that attention was called in any marked degree to the important part which a building might play in increasing production and lowering its cost. This idea has grown and taken firm root, but it is by no means recognized universally. This is very apparent from the many industrial plants that are continually being erected whose buildings are strong evidence that they have not had the consideration and study which is essential for the greatest efficiency and success in any manufacturing business.

Since nearly all modern factories now have labor saving and automatic machines which are more or less perfectly adapted to the most economic production of their products, the opportunity to surpass the competitor in the struggle for increased business evidently does not lie in the direction of improved machinery. The changes have nearly all been rung on this score, and it may be assumed generally that all manufacturers are about on the same footing as far as improved machinery is concerned. To what source, then, can a manufacturer turn for the future development of his business and an improvement in the economic production of his product and the increase of the intrinsic value of the product itself?

In a survey of the possibilities of such improvements, based upon the present character and conditions of the great mass of manufacturing industries, the one outstanding opportunity which promises the largest return, and seems to invite the most serious consideration by every one concerned, is the possibility of the improvement and development of the industrial building itself and its equipment and appointments.

Such a statement no doubt will not appeal to nor meet with sympathy among those who have never given serious consideration to the important part which a well planned and well designed industrial building may be made to play in the production of a manufacturer's product. This is perfectly natural, for the peculiar and yet very important reason that it is absolutely impossible for any one who is not specially qualified as a skilled designer and planner of buildings to tell whether the design and arrangement of a building is ideal or not. Even an expert cannot determine this without a careful study of the problem after acquiring a knowledge of its requirements, unless the defects of such a plant are most pronounced. A plant may be far from what it should be and yet appear to be in every respect well adapted for the use to which it is put. As a matter of fact, there may have

MISSISSIPPI

A Pattern for Every Use

MOST practical and efficient form of window protection against fire and breakage. Reduces insurance and cuts cost of maintenance to a minimum. Compare *Mississippi Wire Glass* with any other manufacturer's product and be convinced of the importance of specifying outright—

MISSISSIPPI

The Pioneer Product



This Coupon Brings a Sample of FACTROLITE and Full Data

Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way.

Name .....

Address .....

Mississippi Wire Glass Company

219 Fifth Avenue, New York

Chicago, Ill. St. Louis, Mo.

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been ways by which that same plant could have been built so that very important additional advantages and betterments could have been secured not only in the methods of production, but also in the quality of the product itself.

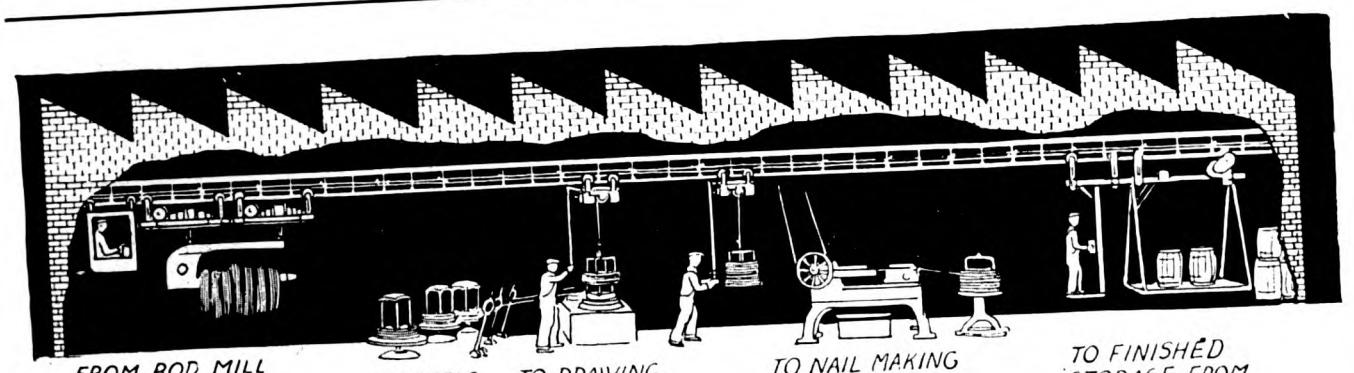
How, then, can the building affect materially the production of the product and reduce its cost? The answer to this question covers a multitude of things and varies according to the kind of industry concerned. Different kinds of industry have established in some cases quite definite types of buildings, and then there are the multi-story factories in the crowded districts of cities and the great expansive plants where space is available to spread out and build any kind of buildings desired. There are those types of buildings devoted to the production of food products, shoes, textiles, clothing, steel, iron, etc., yet notwithstanding this, the principles underlying the efficient planning and designing of buildings will be found in the main to apply quite generally to all these different types.

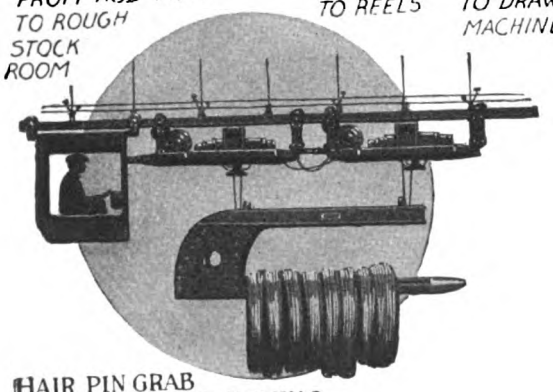
While a building may not claim much credit for the advantages of its location, still it is equally true that a building can not perform its functions best unless it is located so as to fulfill the important requirements, such as: The center of the market for the sale of its product; proper access to materials and supplies; good transportation; opportunity for securing the most suitable employees; favorable building conditions and power requirements; room for expansion; proper foreground and surrounding conditions, and opportunity for the recreation and housing of employees.

In a manufacturing industry, the making of the product usually involves several distinct processes, which originate in the open yard, in separate buildings, or in different rooms or departments of the same building. The raw material may be a single substance or a number of substances that require preparation before they can be incorporated in the make-up of the product. As production proceeds, other substances or parts made perhaps by some other manufacturer, may have to be combined with the original ones. The various processes may be simple or complex in the extreme. In fact, the operation of a single plant may be so complicated that its various processes of manufacture may extend out from the main flow of production like the tributaries of a great river. However, the flow of the production must not be allowed to wind or bend materially from its direct course, and there must be no obstacles to retard its course.

The parts of the building, therefore, should be so arranged that in the manufacture of the product, the raw material is made to travel logically and directly through the plant from

(Continued on page 46)





HAIR PIN GRAB DESIGNED *for* CARRYING RODS FROM MILL TO ROUGH STORAGE *or* DRAWING ROOM

CLEVELAND TRAMRAIL SYSTEM

HAND-OR-ELECTRIC

Just what the Wire Mill needs for a steady and easily handled supply of bundles and coils in and through every department from rod mill to shipping department

Labor costs have never been lower—raw and finished materials have never reached such high production marks—as those in which Cleveland Tramrails are employed.

It's a simple flexible single-rail system suspended from the ceiling beams or roof trusses and easily arranged to serve every drawing bench and machine.

With special coil carriers—stripping hooks—and a suitable application for each particular process—it becomes the greatest time, labor, and money saver, ever installed in a wire mill.

Its possibilities are unlimited.

Ask us for facts and figures concerning your mill.

Our engineers are ready to serve you.



PUSH BUTTON CONTROL CARRIER DESIGNED TO REMOVE BUNDLE *of* RODS AS THEY ARRIVE FROM ROD MILL AND PLACE THEM *on* REELS *for* DRAWING.

CLEVELAND ELECTRIC TRAMRAIL

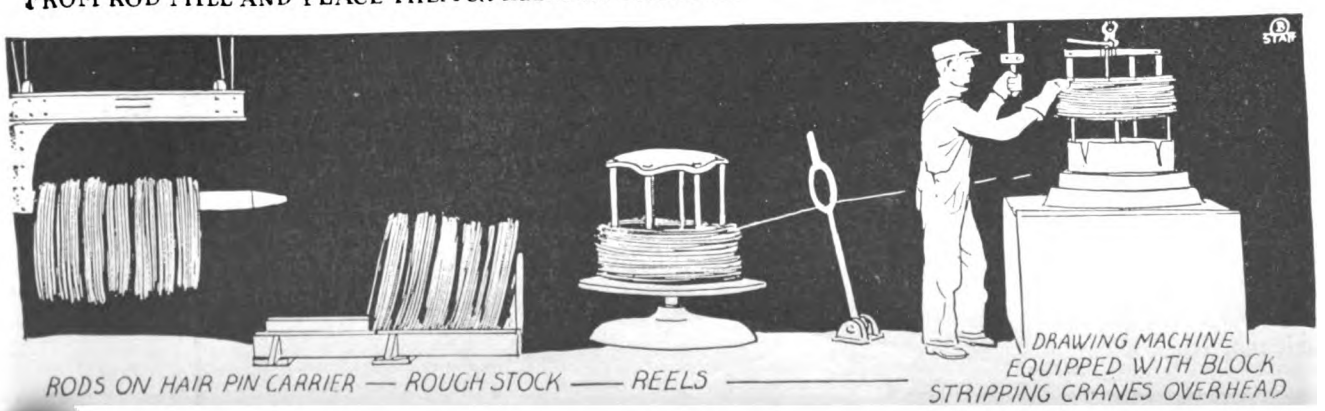
DIVISION OF

THE CLEVELAND CRANE & ENGINEERING CO.

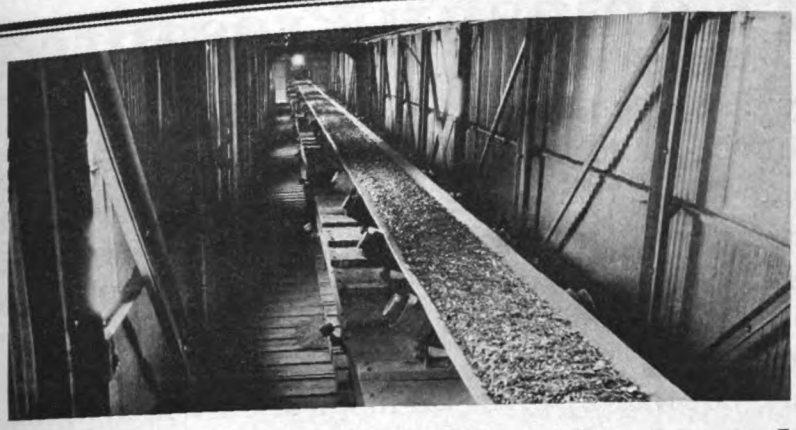
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Reduce Your Handling Costs and Increase Your Profits

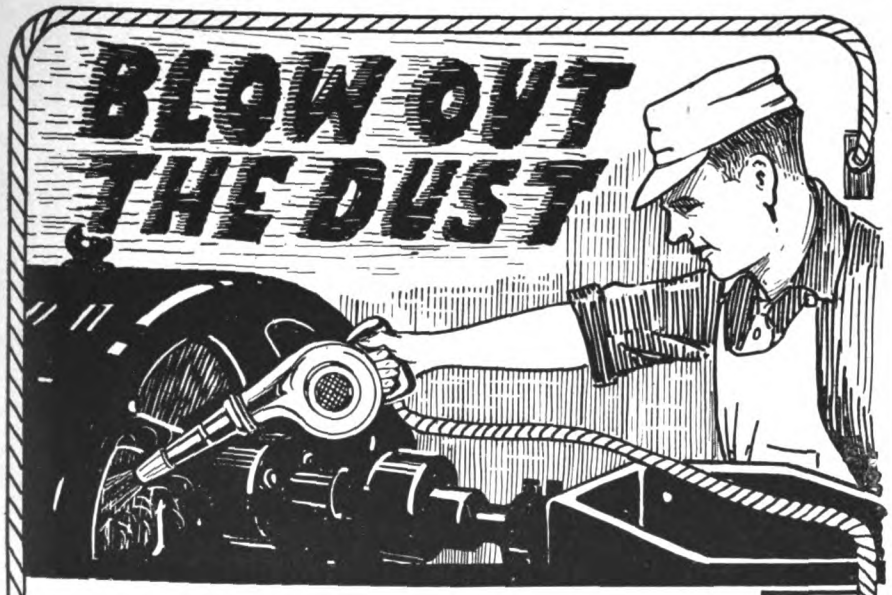
ANY equipment that reduces the cost of handling your bulk materials and products in the process of manufacture automatically increases your profits. The carrier that pays the biggest returns on the money invested for its installation, cost for operation and upkeep is the *Belt Conveyor*.

Conveying systems to function properly must be designed to meet your specific requirements. Our experience of more than twenty-five years in this particular field qualifies us to co-operate with you in the design of such equipment to meet your special requirements. Write for Handbook of Conveyor Practice.



"Built to Carry On."

ROBINS CONVEYING BELT COMPANY
15 Park Row, New York
CHICAGO PITTSBURGH BOSTON



With a CADILLAC Portable Electric BLOWER

The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc.

Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

Weighs only 6 lbs. Complete in itself and requires no expensive installation or equipment. No condensation as with compressed air. Attached to any light socket.

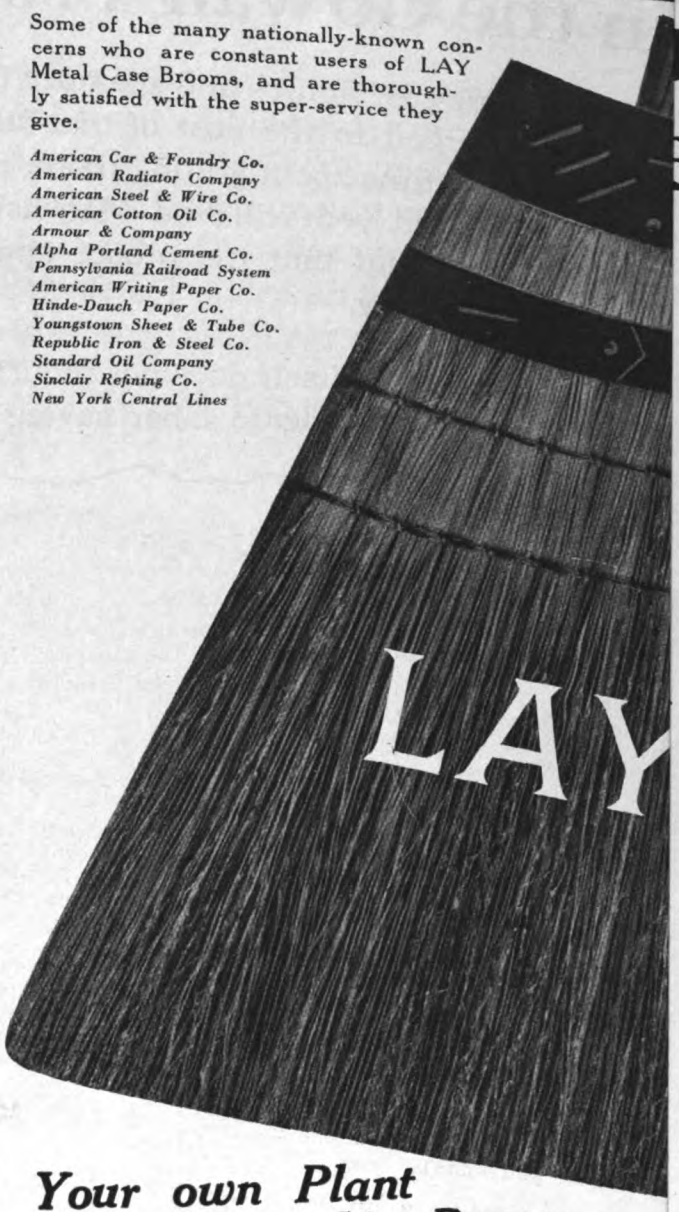
The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories, and every line of industry.

Write for descriptive folder giving prices and testimonials by leading manufacturers.

CLEMENTS MFG. CO.
Manufacturers of the Cadillac Electric Vacuum Cleaner
612 Fulton Street, Chicago
Canadian Factory: 76 DUCHESS ST., TORONTO.

Some of the many nationally-known concerns who are constant users of LAY Metal Case Brooms, and are thoroughly satisfied with the super-service they give.

American Car & Foundry Co.
American Radiator Company
American Steel & Wire Co.
American Cotton Oil Co.
Armour & Company
Alpha Portland Cement Co.
Pennsylvania Railroad System
American Writing Paper Co.
Hinde-Dauch Paper Co.
Youngstown Sheet & Tube Co.
Republic Iron & Steel Co.
Standard Oil Company
Sinclair Refining Co.
New York Central Lines



Your own Plant Made this Broom Possible

Forty-four years ago, the Joseph Lay Com its policy of specialization—a special kind of type of factory. As each new industry appe manufacturing horizon, its sweeping require mediately investigated, and a broom perfected serve it best and longest.

The extra-wide sweeping tip, the stron struction, the stiff fibre center that can cut th and the perfect balance, all combine to make Broom the most economical sweeping instrume

Now is the time to order your 1924 su Send for a Lay sample to-day. Each o fully guaranteed; we assume all risk.

The Joseph Lay Com
120 College Street,
RIDGEVILLE IN



No. 256-144
Steel wire
Push Broom

We make also, a full line of industrial brushes—each one carrying the same unconditional guarantee of the brooms.



Lay Metal Case Brooms are finding a ready market among construction com debris must be handled and wear is terrific.

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DIANA

PUSH BUTT
TO REMOVE
FROM ROD

No. 3-W
Steel Wire
Casting Brush

ant inspection dur-
manufacture insures
l workmanship and
est of materials.

panies where heavy

RODS ON HAI

chinery in its proper place, vision made for all bench rk and special processes along way, mechanical methods for ndling and conveying things vided for, all railroad and ick service brought in at the ht places, and the whole oper- on so arranged that the most ective supervision of the work d the most complete organiza- tion of the operating forces can be made.

In addition to providing for these processes of manufacture, there is nearly always the question of future growth and development to be taken care of in the plan and design of the plant. There is hardly any one who builds that does not expect to increase his business in the future. If one were to attempt to provide space at first for complete expansion, the unused space would add unnecessarily to the overhead and carrying charges; so the thing to do is to provide all along the line for future growth by adding to the building in the future. Sometimes this is a most difficult problem and requires a great deal of study.

In laying out the floor plan for present needs, it frequently happens that some part of the building needed now may cut off the possibility of future extension, or something may get in the way of future growth. Then again should be avoided if possible, the gaining of future space by adding stories above, as this involves the moving of elevator pent houses and other mechanical things. It is better to build the plant the full height as far as it goes if this can be managed. Usually the best way is to lay out the whole plant for the complete future expansion as far as possible and then work backward, by elimination to the part of the plant to be built first.

To plan and design the building so as to best suit all these conditions is the great problem. The manufacturer knows his requirements and the result he wishes to attain, but unless he is a skilled designer and planner of buildings, he cannot possibly make a plan and design for his building that will secure for him all the advantages and economies in production which he should have if he is going to enter this new competition which will come through the perfection and development of industrial buildings.

For the building to serve to its greatest capacity in the industries, the whole question of its design and construction may be concerned, such as its foundations, column spacing, floors, windows, overhead lighting, artificial light, elevators, conveyors, walls, partitions, type of construction and in fact, everything that goes to make up the completed building. There is always a choice to be made of these things, based upon experience, which should select the best one for the purpose in hand, or it is quite possible that special constructions in some cases would be the only way to serve best the purpose.

When it comes to the planning and arrangement of the building, what a great opportunity

(*Continued on page* 48)



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There is a Stuebing Lift Truck for every interior hauling need

Without doubt, the main attribute of Stuebing leadership is the ability quickly to analyze your material handling problems, and furnish a type of lift truck which completely meets your need.

Narrow aisles and congested quarters are obstacles which the Single *Side* Lift Stuebing—*a new model*—is specifically designed to overcome.

Do you load freight cars or move heavy loads up inclines and over crossings? For this we furnish the Stuebing Easy *High* Lift—a multiple lift with side action.

You may have unusually heavy or bulky loads to move. For this purpose we build the Stuebing *Heavy Duty* Truck or the Lift Truck Trailer.

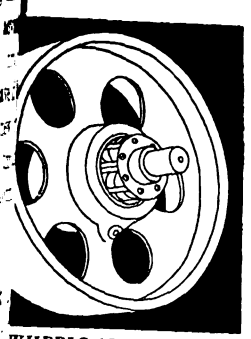
Very likely, however, your trucking requirements are not unlike those in a thousand other plants wherein production schedules are met with a type of Stuebing Truck that for ten long years has held the leadership in sales over any other type or make.

Until you investigate it you do not know how closely the Stuebing System fits your need for *efficient*, *inexpensive*, *safe* and *quick* movement of materials.

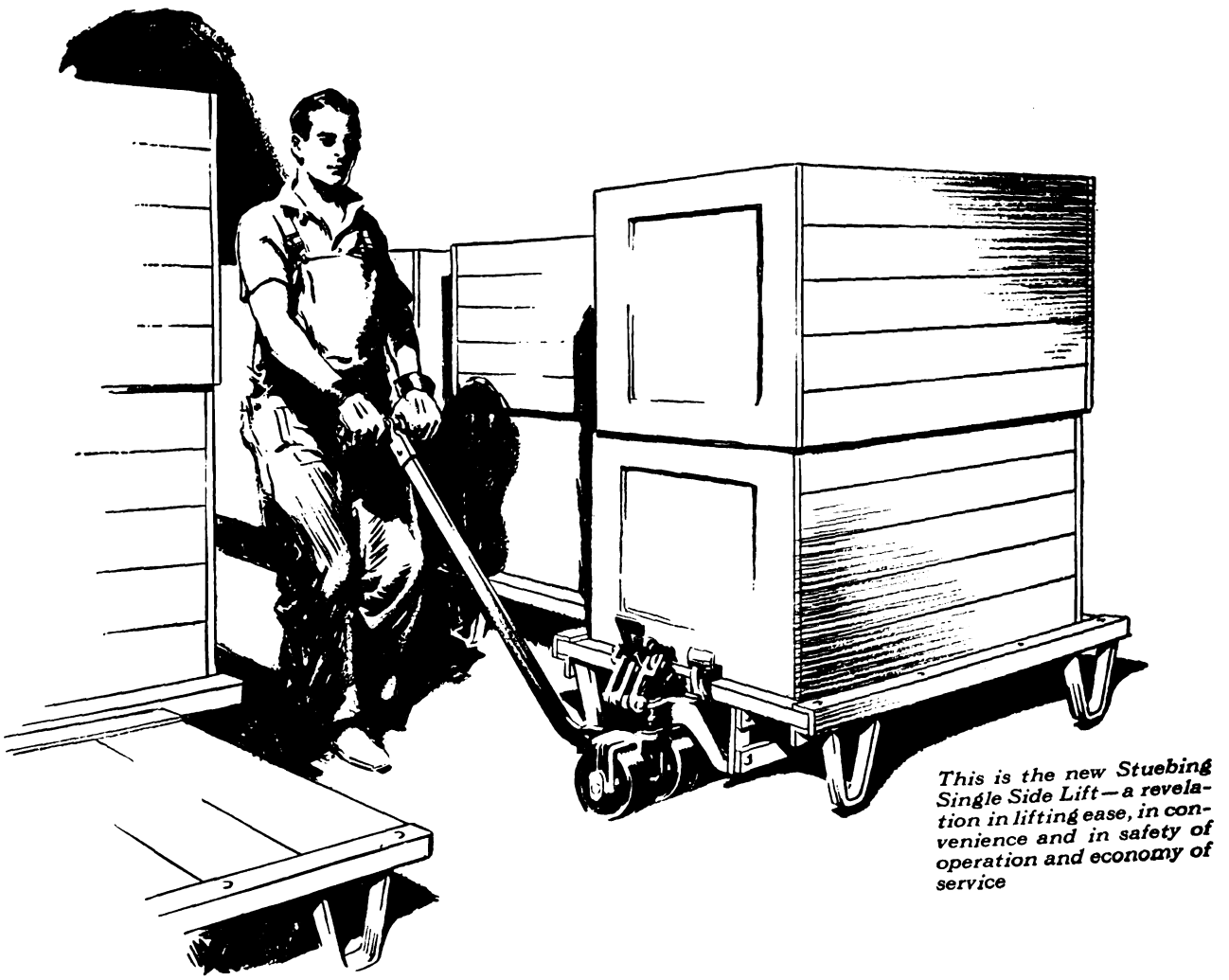
After you have had a demonstration of a Stuebing Truck—and see how nicely it meets your conditions—you will use no other.

Phone or write our nearest representative, who will show you a model; or write us direct for our new 36-page catalog, a complete handbook of material handling equipment.

THE STUEBING TRUCK COMPANY
Cincinnati, Ohio — Montreal, Quebec
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WHEELS ARE STANDARD
tebings, for no other but steel
in assure the long lifetime of
ree service required of a Stue-
illed wheels (standard with lift
kers generally) can be had if pre-
All wheels are Hyatt-equipped



This is the new Stuebing Single Side Lift—a revelation in lifting ease, in convenience and in safety of operation and economy of service

StueBing

LIFT TRUCK SYSTEMS

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NO OTHER LIFT TRUCK IS BUILT LIKE A STUEBING!

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(*Continued from page* 46)

there is to attain results that the inexperienced planner would never dream of! How often has an important plant been built from the first or second sketch of a draughtsman or a man who makes machinery, without even trying to apply the many different layouts or arrangements that might solve the problem better than the one adopted. A man who is skilled in planning would usually make many plans for an important plant, until he had drawn out every feasible way in which the building could be arranged.

This is the only way by which all the good features can be revealed for consideration and study. By a process of elimination and selection, a composite plan in this way can be built up that will have advantages and sometimes features of great value that could never come from an unstudied plan or layout of an inexperienced man.

The making of these plans, if properly done, should carry along with it the forming or moulding of the elevations, or exterior design of the building, at the same time, as the exterior of any building should always express truly its plan and arrangement, and they should always be developed together.

The reason that so much emphasis is laid upon the making of the plans is that comparatively few people realize that the planning and designing of a building can only be done properly by persons who have had a long training and preparation for this work. In studying the plan and design for a building, it is the faculty of the imagination which is brought into play to invent, create and suggest to the mind the various solutions for the problem, and it is for the mind or reason to select and apply the best of these solutions to the problem. If the mind is not stored with knowledge of this subject and if the imagination is not specially trained in this work, the result cannot be anything but that of a novice; and yet many plans for buildings which are full of lost opportunities are constantly executed and thereby irrevocably transformed into brick and mortar.

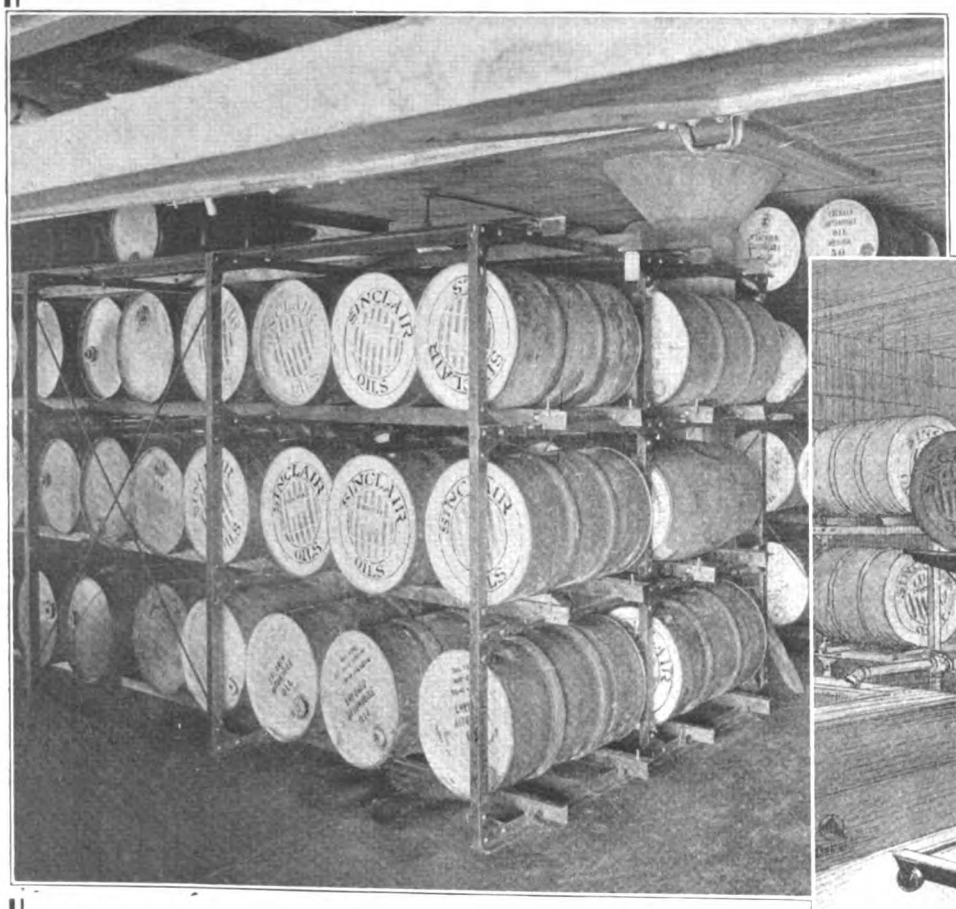
Another way in which the building affects production is through the employees. It goes without saying that a man is more likely to do his best work in a perfect workshop. The greatest possible incentive to secure faithful, conscientious and efficient work is to arouse an interest in the work for the workman, and plan and equip the building and its surroundings so that they are well suited for the work, complete in their provisions for the daily life of the workman and at the same time just as attractive and pleasing as it is possible within a reasonable expense to make them.

If it be true that the annual loss to manufacturers is anything like what it is reported to be, and if it be true that attractive, efficient industrial plants equipped for the average welfare work reduce materially the turnover of labor, then it would really be economy for every manufacturer to go the limit in this direction and make his plant a model in every respect.

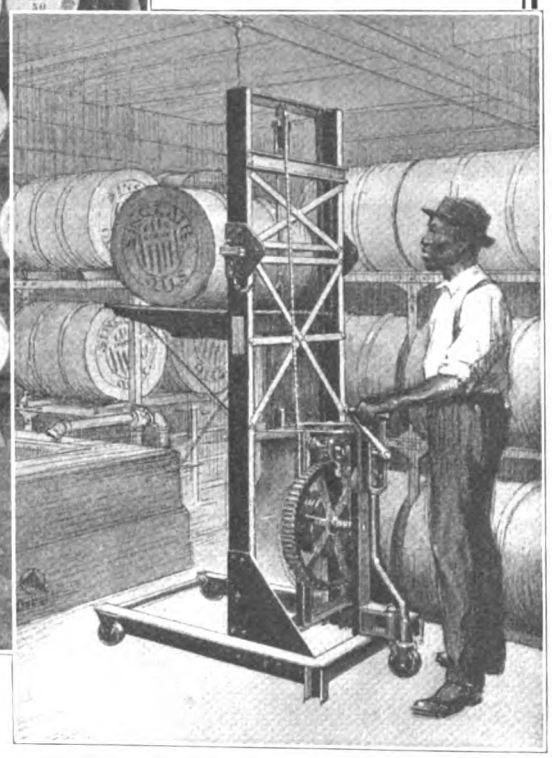
According to the authorities who have gathered abundant statistics to prove their statements, the turnover of labor or "the hiring and firing of employees" for the years in which the records were taken, reach

(*Continued on page* 50)

ECONOMY SYSTEM *of* STORAGE HANDLING



Racks *and* Portable Elevators



Save Space by Using Economy Racks

Portable Elevators

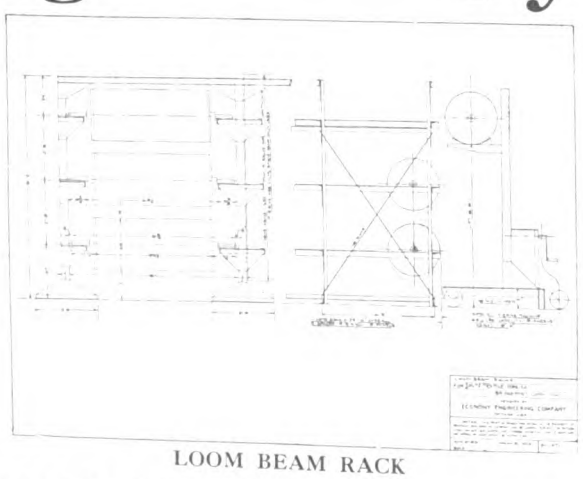
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Loom Beams
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Tote Boxes
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Cases

ECONOMY ENGINEERING COMPANY

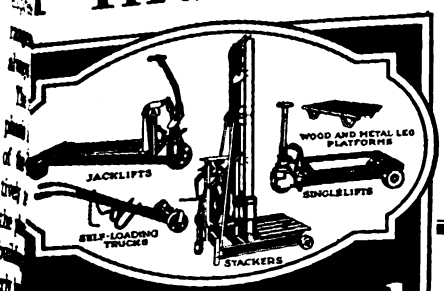
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OVER 5,000 business firms show handsome yearly profits on L-S products. 600 per cent is the experience of average users. Multiple uses are discovered almost daily for saving labor, time, space and money in your particular line of business.

Our catalogue covers 32 major lines of business which L-S Products serve. Our detailed up-to-date data include over 150 lines of business. We guarantee results with every installation. TODAY'S Correspondence is the best **Short Route.**

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ast First Street, Boston, Mass.



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The Revolvator line of portable elevators or piling machines covers every situation where goods are piled in warehouses or stock rooms. Revolvators are made in nine standard models—hand operated, motor-driven and combination hand or motor operated, all with either revolvable, non-revolvable or open end bases. When necessary special machines can be built to handle unusual piling conditions. Revolvators are sturdily constructed, easily operated whether elevating or lowering material and for rapidity and economy in piling goods show wonderful results. They will handle material up to 4000 pounds in weight.

Send for Bulletin E-60 *and secure further details. Write today.*

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Signed .....

Use your pocket knife or shears. If they are not handy tear out the whole page. But do it today.

Taylor Instrument Companies

Rochester, N. Y., U. S. A.

Canadian Plant, 110-112 Church St., *Tycos* Bldg., Toronto.

There's a *Tycos* or *Taylor* temperature instrument for every purpose.



Move this Platform Where You Please

"Dead" Platforms mean dead loss in valuable time. In crowded aisles, in the stockroom and upon the shipping floor they are always in the way—slowing down production and offering an opportunity for idling till a lift truck can be found.

Zering Live Platforms

Move on ball bearing, swivel casters without the aid of a lift truck. Short hauls of raw materials or finished products are accomplished without loss of time. Fewer trucks and fewer hands are necessary with ZERING LIVE PLATFORM equipment. Confusion is avoided. Quicker, smoother factory operation is the result—often at a saving of from 10% to 50% in trucking costs.

ZERING LIVE PLATFORMS are sturdily built to stand abuse —in styles and sizes to suit every trucking need. Their low cost makes them doubly economical.



Patent Pending

Champion Adjustable Double Race Casters

These patented double race casters are standard equipment upon all ZERING LIVE PLATFORMS. They are trouble-proof, practically wear-proof, quick-acting and make heavy loads seem light. All wear in the ball races is taken up by an adjustable nut. Casters need not be removed from truck.

THE H. ZERING MFG. COMPANY

4425 Enyart St., Oakley Station,
Cincinnati, Ohio

Manufacturers of Trucks, Trailers, Casters and Skids

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(*Continued from page* 48)

the most astonishing figures. They assert that the average concern "hires and fires" as many employees every year as it carries on its payroll, and that the average cost to replace a workman is $50.00. So that if a man had 1,000 employees, he would have to hire 1,000 new employees every year to keep the number up to the thousand mark and it would cost him $50,000 annually.

If the same loss from labor turnover is going on now throughout the country, the total annual loss, assuming that there are 8,000,000 industrial workers, would be the colossal sum of $400,000,000!

The remedy for excessive labor turnover is unique compared with other losses. It cannot be cured by the enforcement of any set rules, as a man always has the right to quit his job and he can usually get the same wages by going to some other plant. The remedy, therefore, must be something which will appeal to him and which he will voluntarily accept.

The most reasonable and natural way seems to be to make the plant attractive to him and as complete for his comfort, convenience and general welfare as is possible to do.

Some records have been made of the effect upon employees of the attractiveness of a plant and its provisions for welfare work among the employees, and the results obtained have shown a marked decrease in labor turnover and an increased spirit of loyalty and coöperation among the employees. In fact, the best evidence of its success is the fact that those who have tried it are well satisfied with their results and could not be induced to conduct their business on any other basis.

The cost of those plants which have attractive buildings and surroundings may appear to the uninformed as being excessive, and yet as a matter of fact, the difference between the ugliest box of a building and one which is architecturally attractive and sometimes beautiful and also equipped for the chief welfare work, has been found by actual experience to be only from two to three per cent. of the total cost.

The industrial building usually offers one of the best opportunities for securing attractive architectural effects at a reasonable cost. This is true on account of the chance to mould into attractive forms the many different shapes and kinds of shops and parts of buildings which go to make up the industrial plant, the opportunity often afforded of making a beautiful tower out of the sprinkler and water tanks, and the fact that it is often possible to set the building back sufficiently from the lot lines to break up the monotonous long walls with pavilions, gables or projections, and best of all, the opportunity to do a little planting of trees and flowers in the foreground of the building or at some place which will give a touch of beauty and attractiveness to the plant which could not be secured by any other means.

In the onrush and struggle for supremacy among the American industries, there could be no finer record left to posterity by the people of our times than for the competition among them to turn towards the betterment and improvement of their plants along these lines. There is no question but that all concerned would benefit thereby.

Keeping in Step with Progress

The demands of present day boiler room operation, with the higher steam pressures, superheat and higher temperatures have resulted in the New Troy engine—a worthy addition to the regular Troy line.

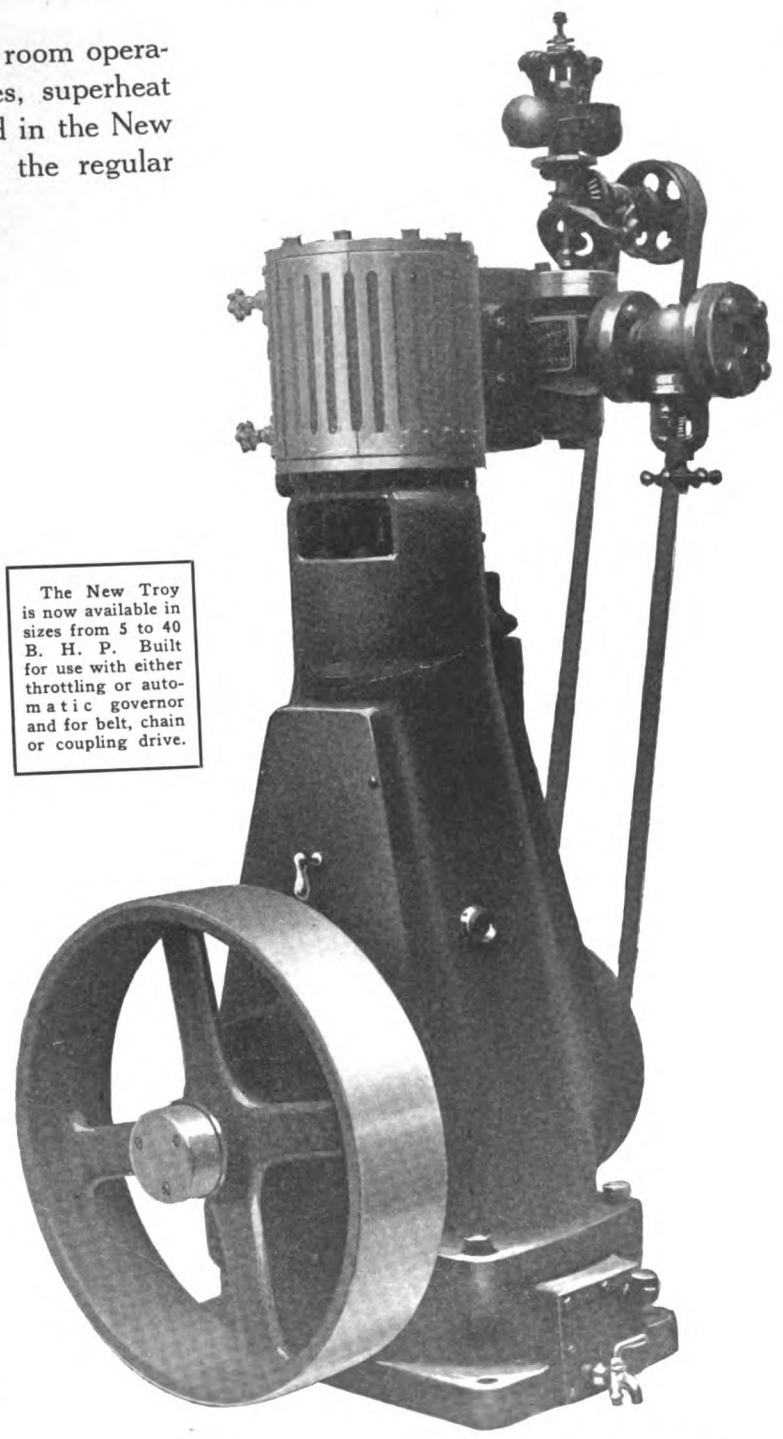
The New Troy is especially adapted to drive modern stokers. It is of extra heavy construction with large overload capacity to overcome resistance offered by stiff stoker shaft bearings in starting. The New Troy meets every demand for greater power in the smallest space possible.

It is of heavy design, fully enclosed and carefully balanced. It is dust proof and, of course, is designed with the Troy system of lubrication which supplies each bearing with an abundant supply of lubricant. The number of parts subject to wear and replacement has been greatly minimized.

Troy Engines have long been known as the most dependable steam units for driving fans, blowers, compressors, pumps and generators; for stoker operation and also for main power purposes.

Send for the Troy Catalog

Troy Engine & Machine Co.,
TROY, PA.



The New Troy is now available in sizes from 5 to 40 B. H. P. Built for use with either throttling or automatic governor and for belt, chain or coupling drive.

Built in Sizes From 2 to 200 B.H.P.

ONLY STEAM ENGINES GOOD ENGINES ONLY

TROY ENGINES

ONLY STEAM ENGINES GOOD ENGINES ONLY

DEPENDABLE POWER with ABSOLUTE SAFETY

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Shop Courtesy

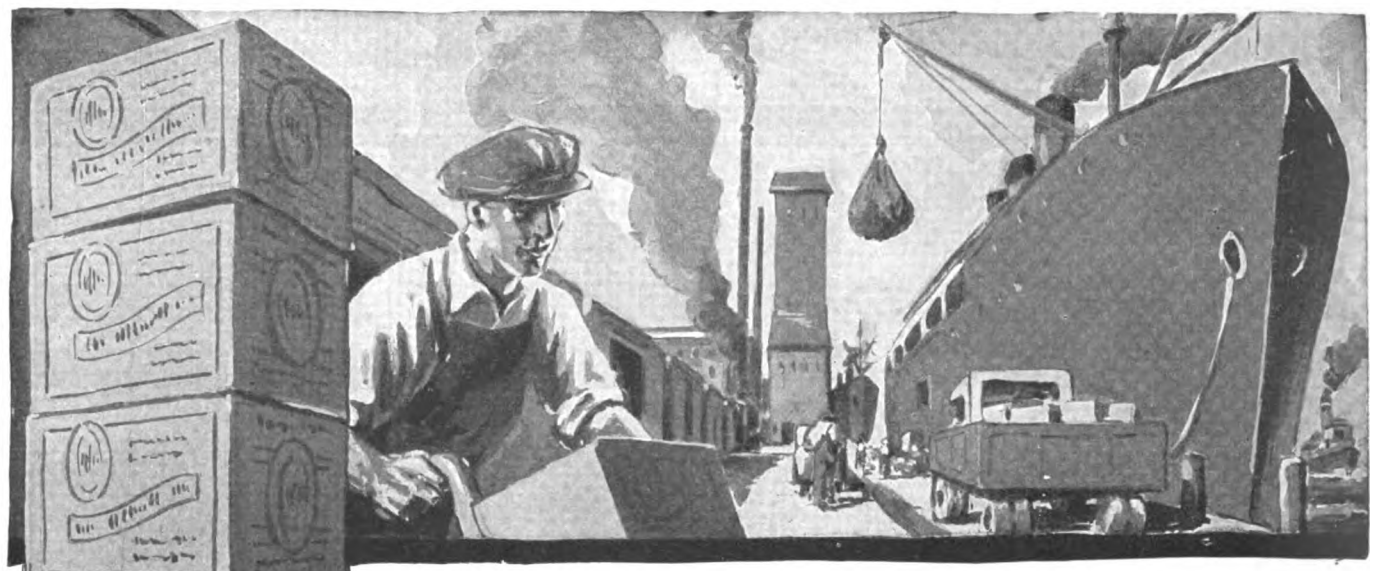
By O. C. Richards

NY people greatly un- ervalue courtesy about he shop. The man who among his social ac- ces, as a most agree- leman, is often a con- ouch with his business s. In the average fac- ual courtesy among the is one of the biggest in keeping down the rnover, and makes the ractive to old and new ce. When new people d, they naturally feel less lost at first in the roundings. Girls who ver worked in such a efore, are particularly ake a dislike to the shop, are not made to feel at Both men and women orm cliques and some- ttempt to freeze out new I have seen this in a of instances and have t a very difficult situation lle.

ng the old employees, re always some who are ish that their associates hem a constant source pleasantness. Whenever men are asked to give a ey are busy, whenever one has to obtain material ne common use of the they always try to dodge. people would be surprised ow how much they have d themselves in the esti- n of their fellows.

workman has it in his to make life pleasant or disagreeable to his fore- The habitual grouch does nown how to be courteous, t does not take many such ke the joy out of life for oreman. Such a man is ready to do any little task or assist his superior y way he can avoid. The day I saw an excellent ex- e of courtesy. A new man misunderstood his instruc- and was not willing to heed suggestions of the experi- d men near him. One of the hunted up the foreman and ained the situation. It pre- ed spoiled work and gave foreman the feeling that he friends who wished him ess.

is very difficult to so assign k as to give each workman even chance to earn, and there are men who are always complaining of the jobs they get. At one time, in a department of which I had charge, jobs were lined up on a production board in the order in which they were to be given out. It became a habit with several men to plan the finish of their job, or rather their trip to the desk for the next assignment, so as to avoid any undesirable job they saw on the board. This selfishness and lack of consideration for others made it necessary to turn the





why more than forty million H&D Boxes were used last year.

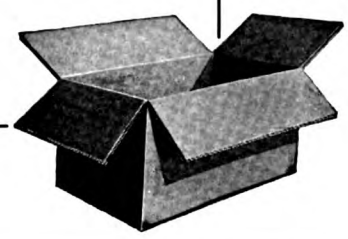
At busy depots—on wharves and shipping platforms—in spacious warehouses—in speeding express trains—on lumbering motor trucks—wherever there is merchandise going to market, you will find these clean-looking, sturdy H & D Shipping Boxes in surprising numbers.

Their known ability to deliver merchandise intact always, their adaptability to widely varied packing requirements, their low cost, their advertising value, their sales helpfulness, their unequalled all-round fitness to carry everything from fine glassware to rubber boots—has made them the most practical and widely used of all containers.

The H & D Box Catalog should be in your purchasing department's hands. A reference to it before ordering your next lot of boxes may suggest some economies over your present packing methods that will surprise you.

Sent upon request.

The H & D Package Planning Department has developed some of the most successful containers in use today. It will design for you—free of all charge—a box that will exactly fit your goods and carry them most economically. Just send us a sample shipment—for repacking and return.



The Hinde & Dauch Paper Company

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Canadian Address: Toronto—King St. Subway and Hanna Ave.

The World's Largest Manufacturers of Corrugated Fibre Boxes and Packing Materials

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backs of the orders out so that there could be no picking.

Courteous foremen are not nearly so common as we might expect. Some foremen think that they do not have to be civil to those under their charge, since they have the authority to order them about. Such men have the old school idea. The progressive man realizes that it is an art to direct others and that requests are far better than arbitrary orders. It does not lower prestige to be courteous, in fact the consistently courteous foreman is apt to be highly esteemed. The Vice-President of a large manufacturing concern is a very quiet man, and is noted for his polite manner. One of his immediate subordinates was telling me, at one time, how effective the quiet questioning of this man was when someone had been lax in his duty and had to be reprimanded. The narrator had recently been on the carpet before this Vice-President and had come out of the private office with increased respect and admiration for his superior.

Foremen and others in a shop often find that they have to deal with those who are more or less on an equality with them, so that it is neither a case of order or obey orders. Courtesy is an invaluable asset in such instances. Some men are never able to obtain what they want under these circumstances without resorting to a great deal of trouble and possibly unnecessary red tape. I was once talking to the foreman of the maintenance department, in the plant where I was employed, when he said to me, "Here comes Williams. He will tell a funny story and then get whatever he is after." Here was an instance where courtesy and good nature helped a man to get coöperation from his associates. Such cooperation is invaluable and often means the difference between success and failure to the individual.

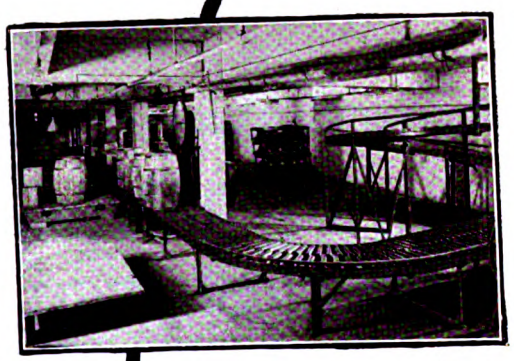
Courtesy as a fundamental policy of a business firm, both to outsiders and between the members of its own organization, is about the most valuable principle I can conceive of. A consistent preaching of such an idea will result in not only a successful, but a happy and contented organization. It is to be hoped that we will have an increased amount of attention paid to shop courtesy.

The novel suggestion that all motor gasoline be colored red as a safety measure designed to guard against its being mistaken for water, kerosene, or other colorless liquid products, is advanced by W. A. Jacobs, chemical engineer, Department of the Interior, who has been detailed by the Bureau of Mines to make a special study of the hazards of gasoline.

The use of the color red is considered almost universally as an indication of danger, Mr. Jacobs points out. On the railroads it shows the engineer that the track is not clear, in blasting operations it warns people of possible danger; traffic officers use it as an indicator that traffic is halted; and in some states all gasoline sold must be dispensed in containers painted red.

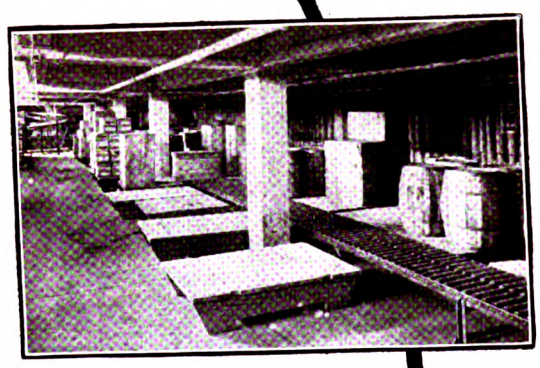
Gasoline is often mistaken for water, kerosene, or some other colorless liquid, and, judging from various newspaper reports, this mistake often results in explosions and fires, and sometimes in loss of life.

Save Labor!
Let Gravity do your Lugging



Eight Trucks Unloaded in Two Hours

Nothing unusual — just a regular performance. There were five truck loads of nails and three truck loads of miscellaneous wholesale hardware items. Two truckmen outside and three men inside put these five loads into storage in record time —*but*, they had a



Mathews Gravity Conveying System

to help them. That accounts for their fast work. The illustrations show three views of the conveying system which we installed for the Baker, Hamilton & Pacific Co., San Francisco. In this system the famous Mathews Double-Roller Gravity Conveyers are employed in both spiral and straight runs. This type permits the handling of a great variety of merchandise packages.

Come to Package-Handling Headquarters

for expert advice and free engineering service. We maintain branch offices in all principal cities. Catalog on request.

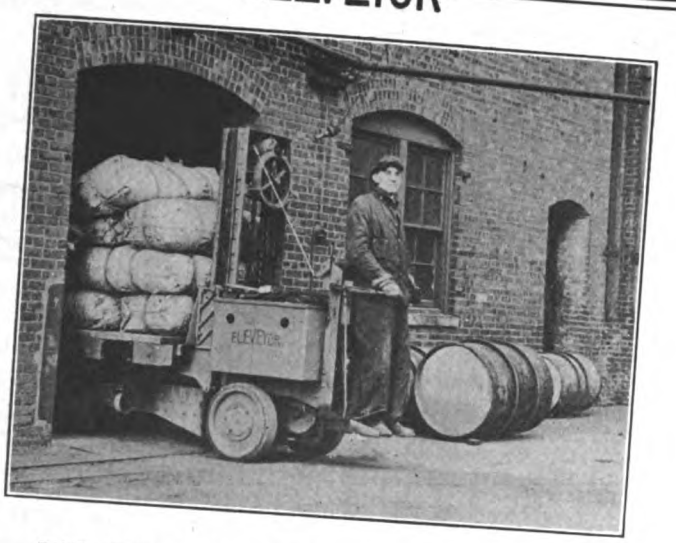


MATHEWS GRAVITY CARRIER Co
·102·Tenth·Street ~ ELLWOOD CITY·PA·
Branch Factories: Port Hope, Ontario - London, England

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SPEED ECONOMY
GRAVITY ROLLER CONVEYER

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ELEVEYOR



The ELEVEYOR (3 Trucks in 1) Saves 66⅔% in Handling Costs at this Plant



Write for Catalog

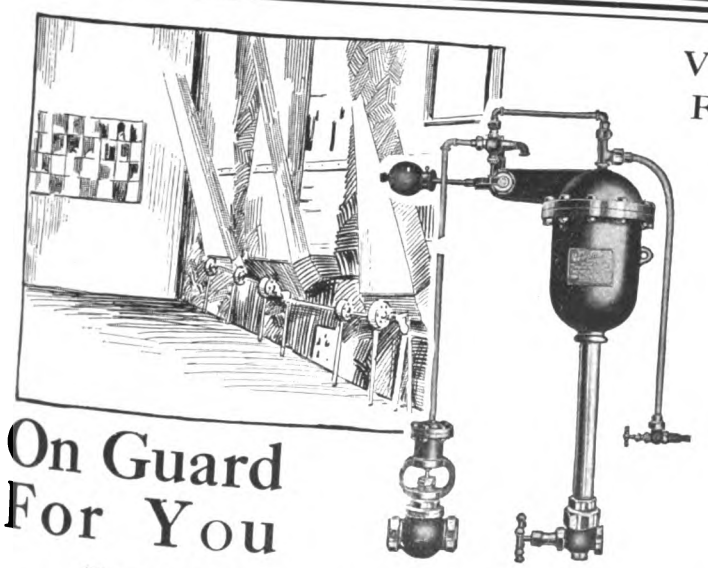
Here is another example of how the ELEVEYOR —the Truck that conveys, elevates and stacks material—saves in handling and storing costs.

In this plant (name on request) the ELEVEYOR has not only effected savings in the storing of raw materials, but has actually cut handling costs 66 2/3%.

We have a practical plan whereby we can prove the economy of ELEVEYOR Trucks, right in your own plant. Let us tell you about it.

ELEVEYOR INDUSTRIAL TRUCK CORP.

56 Huntington Street Brooklyn, N. Y.



VIGILANT Feed Water Regulator

On Guard For You

The necessity for the maintenance of a steady, constant water level at all times can best be realized by those plant managers whose every endeavor is devoted to economical and efficient operation. They quickly appreciate the value of insuring the proper water levels without having to depend upon the uncertain human factor.

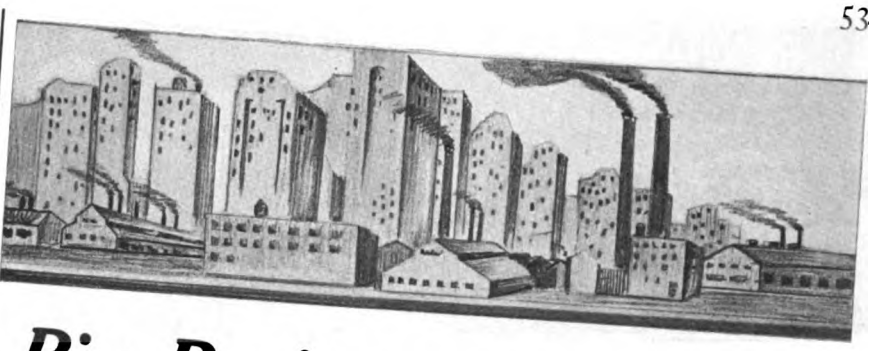
The Vigilant Feed Water Regulator is truly "on guard for you" at all times. It automatically fixes your water level; it prevents explosions; it conserves fuel; it guarantees maximum operating efficiency. Its use will eliminate your boiler room worries to a great extent.

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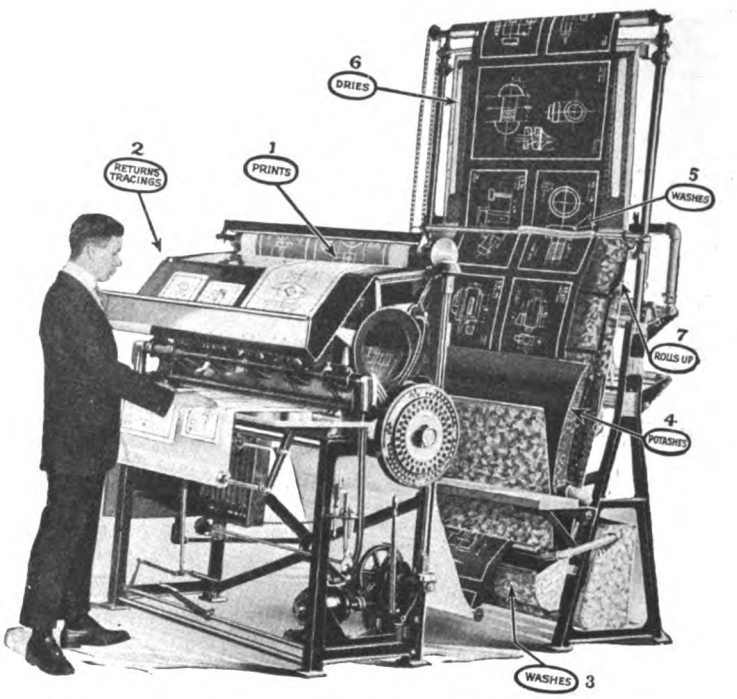
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Big Business and Small

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Among prominent users of Pease Blue Printing Equipment are The American Locomotive Works, Schenectady, N. Y., Western Electric Co., Chicago, Ill., Union Tool Co., Barber-Coleman Company.

Users whose requirements do not anywhere approach those of the above companies are purchasing Peerless Equipments because we have proven that the Peerless is the most economical blue printing machine whether it be operated for as short a run as 5 yards or for its capacity of 120 linear yards per hour.

The Pease Vertical Blue Printing Machine



For use in Plants where Requirements are smaller

The Peerless requires only one operator, and in many cases the machine is run at stated intervals during the day. The operator can thus clear up in a short time work that would require all day by any other method.

In fact, the Peerless Equipment turns out blue prints at one-quarter the cost of any other equipment using independent methods of washing and drying.

Catalog M-23 tells the whole story. It will be gladly sent on request without obligation.

THE C. F. PEASE COMPANY

819 N. Franklin St., Chicago, Ill.

PEASE CHICAGO

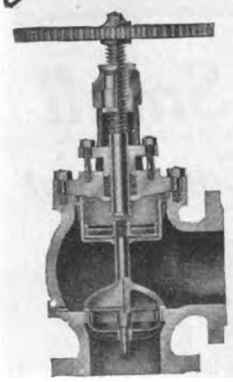
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Made for maximum service not merely the average

TRADE JENKINS MARK

Jenkins Bros

Automatic Stop and Check Valve —for Boiler Efficiency and Safety



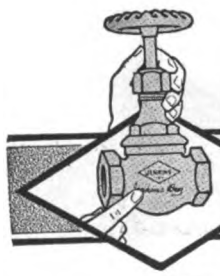
THIS valve opens by the pressure inside the boiler to which it is attached, making it impossible to accidentally turn steam into a boiler which is being cleaned. It also automatically cuts in newly-fired boiler when the proper steam pressure is reached. When the boiler is in operation, should internal rupture occur, the valve closes. The valve also equalizes the pressure between boilers operating in a battery.

Sectional View, Fig. 293, angle, Extra Heavy Iron Body Automatic Equalizing Stop and Check Valve. Sometimes known as "Non-Return" Valve. Made also in cast steel.

Valves in bronze, iron, and steel for all requirements.

JENKINS BROS.

80 White Street .....New York, N. Y.
524 Atlantic Avenue .....Boston, Mass.
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Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

WRIGHT HOIST



ARE you conserving Time—Energy and Costs in your Hoisting Operations?

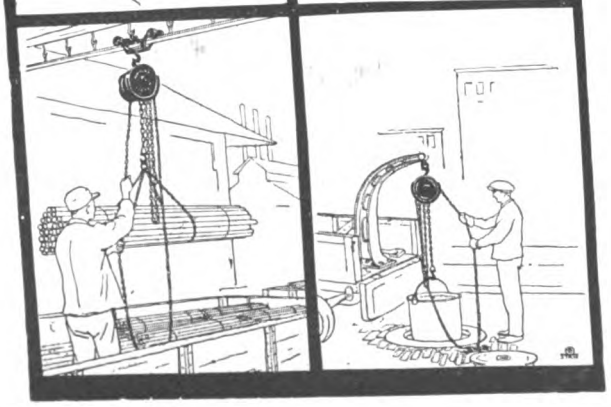
Wright Hoists are built to accomplish these results.

May we tell you how ruggedly they are built?

What's your name and address?

WRIGHT MANUFACTURING COMPANY

LISBON, OHIO



Putting Self-Respect on the Payroll

By LYLE E. DIX

IT is a man's self-respect that makes him most valuable to his employer. It is the satisfaction of doing something useful that incites a workman to put his best effort into his work.

This feature of profit is much overlooked in industry. Putting a man in a treadmill will force him to keep up his end but it will certainly not hold him on the job.

Of course treadmill talent will always be worked in the treadways of employment but the big part of the matter lies in the ability of the executive to discriminate to his advantage.

A gang of pick-and-shovel men were interrogated by a member of the company for which they were leveling off a piece of ground. Some members of the gang were slowly and indifferently throwing a shovelful of dirt now and then while others stood, between shovelfuls, and looked around, viewing the landscape and talking.

The member of the company was a student of efficiency. He inquired of the diggers in a friendly manner:

"What are you fellows building there?"

The reply was: "I dunno."

"Why are you leveling off this ground?" and he looked in vain for an intelligent answer.

This man went immediately to his office and sent for the overseer who was handling the workmen.

"What are you doing with that gang of diggers?" he inquired of the overseer.

"Getting the ground in shape for the foundation," said the man in charge of the crew of workmen.

"What foundations?"

"The foundation for the fire apparatus building."

"How do you know that it is for the fire apparatus building?" asked the executive.

"Because the foreman told me and I saw the blueprints," replied the overseer.

"What is the fire apparatus building for?" asked the employer.

"It is for storing the fire carts, hose, ladders and safety equipment in a handy place."

"Why do we need fire carts, ladders and safety equipment?"

"So we can fight and prevent fires and save men's lives."

"Exactly," said the manager. "Now I want you to go out there where your men are leveling off that strip of land and tell them what they are doing, Mr. ——. Tell them that on that site we are going to erect one of the most important buildings in this plant.

"Put this information over to them so as to give them a part in the building of this plant. If possible, give one or more of them a specific portion of the job. Explain to those men that this is one of the most significant jobs on the works. Tell them what they are making and why they are making it. Do this offhand, not dictatorially. Do it like you were interested and like you felt that they were also interested."

Soon after the overseer left the office, the manager looked out over the great yard and plant and, as his eyes wandered to the site for the new fire apparatus building, he saw shovelfuls of dirt flying—men were spitting on their hands and tieing into the work of constructing something. Their desire to create had found its release for the while, in the erection of an important building for the purpose of fighting fire and saving men's lives in the plant where they earned their living. Their self-respect was sustained by the wholesome reaction of the kind of work they were doing and the way in which they were doing it. They were not simply leveling off a piece of land with no apparent object in view. They were making something.

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ne Passing of the Dinner Pail

By Maxwell Droke

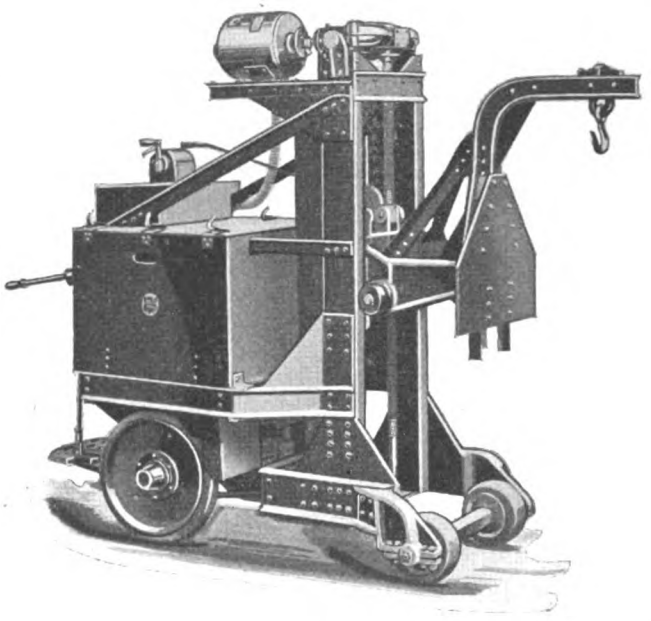
CWHAT less than a eration ago, the full ner pail was a universal f American prosperity. all factory workmen, ıy office and shop em- ıs well, carried to their bor a two quart lard filled with somewhat rovender, against the of noon-time hunger. the dinner pail is al- extinct as the Dodo, r that is. Nobody car- anymore. The doom of ner pail was sealed with ıing of the cafeteria. employee lunch room or a is so comparatively an innovation that no finite standards of prac- ve as yet been worked r its inauguration and nance. But from this ent do not take a broad ıg jump to the wrong sion. The industrial cafe- s not an untried theory. long since passed the mental stage. There are things we must yet deter- concerning the industrial ria. But there is one thing longer have to guess about that is whether or not it worthwhile institution.

industrial cafeteria as we it today is not the result er-night growth. It has a steady, step-by-step de- ment to its present state aturity. The earliest fac- restaurants were an out- th of the idea, in a few utions, of serving the man free coffee or milk to lement his cold dinner-pail ı. So favorably was this received that it was not before the factories were ing soup and crackers. In instances this latter addi- was served without cost; ther cases a charge averag- about five cents per portion made. From this point it only a step to the full-meal rice offered by most modern ory cafeterias.

The plant-restaurant idea is wing at such an amazing e that it is scarcely practi- le even to hazard an intelli- ıt guess as to the number of se restaurants in successful eration. Figures become ob- ete before they find their way o print. As far back as 1917 the Bureau of Labor conducted a survey of 431 establishments, in a great variety of industries, for the purpose of determining, among other things, the provisions made for furnishing meals to the employees. It was ascertained that of the total number 224, or slightly more than 50 per cent, maintained lunch rooms. We can safely assume that, in the interval, the percentage has materially increased.

At the time this investigation was made it was found that the

The Latest Tier-Lift Development



The crane attachment has a capacity of 2500 lbs. combined with a vertical lift as high as 80″. This has opened up new possibilities of application of the original "Tier-Lift" idea, which was brought out in 1919. The crane combines a carrying service and high lift—it already is in operation in an industry which previously was unable to apply electric trucks.—How can you use it?

Below is shown the Fork Attachment on the "Tier-Lift" Truck, which has made possible the handling of loads without skids—substituting therefore two 2″ x 2″ strips. Products like tin plate, paper, bales, barrels, crates and boxes can be quickly and cheaply transported and piled.

The original "Tier-Lift" with its 4000 to 6000 lbs. capacity with lifts up to 96″ has made possible large savings. Its worth is emphasized by the many attempts to copy its valuable features.

The foregoing products are protected by Patent granted October 17th, 1922, and other applications pending.

We shall be glad to supply you with further information and catalogs.





The Lakewood Engineering Co.

Cleveland, Ohio

Originators and Patentees of the "Tier-Lift"

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lunch rooms were divided almost equally into two classes—those with waiters, and those affording cafeteria service. It is only fair to point out, however, that the growing popularity of the cafeteria in recent years is resulting in a steadily increasing percentage of lunch rooms of this latter type. As a rule they may be more economically operated than the waiter-service type, thus resulting in lower-priced food. And price is a paramount factor in the successful operation of an industrial lunch room.

With very few exceptions the factory lunch room is either owned by the company, or by the employees themselves. Probably less than 10 per cent. of these lunch rooms are conducted by outside management, and the percentage is steadily decreasing. Inasmuch as this is essentially a company welfare enterprise, a large number of concerns prefer to keep the management under organization supervision.

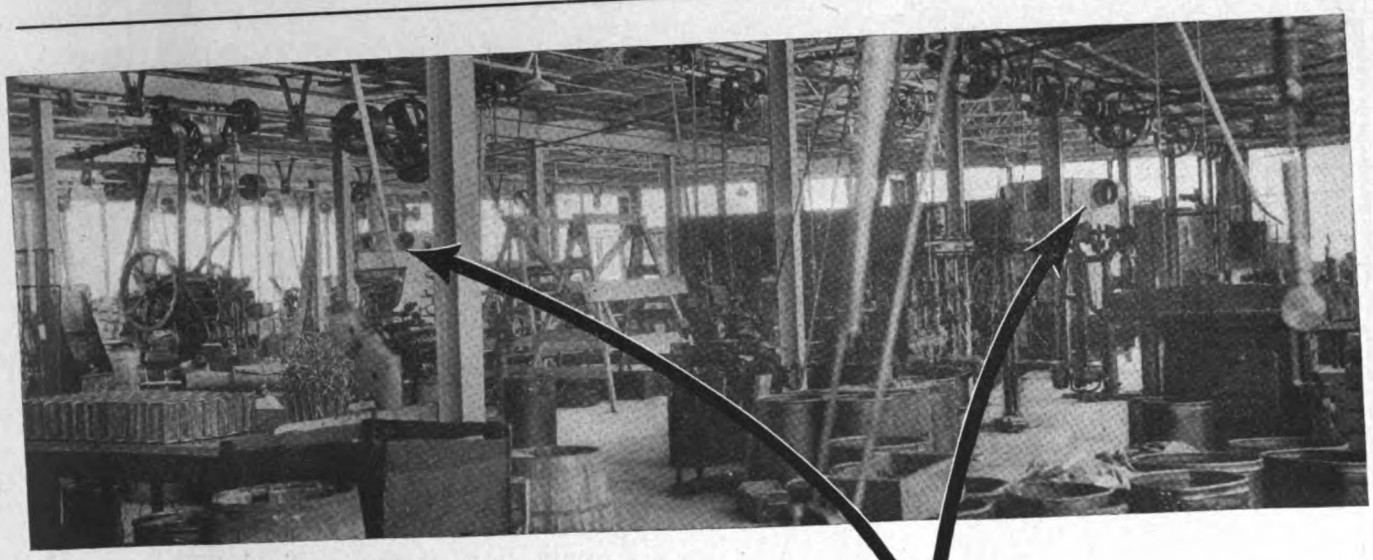
Of the employee-owned lunch rooms, probably the plan followed by L. S. Ayres & Company, the great Indianapolis department store, is fairly typical. In launching this innovation, the company first called a meeting of all department heads for the purpose of presenting the idea. The executives were asked to appoint certain members of their departments to serve on an employees' committee, for the purpose of making the necessary plans.

To this committee the company made the following proposition. We will provide the necessary space for a cafeteria-type lunch room, and furnish light and heat free of cost. Moreover, we will lend you $1500.00 with which to purchase necessary equipment and make a start. This is all we can do for you. From this point on, it is necessary for you to work out your own salvation and put the lunch room on a sound financial basis.

It took the committee exactly one year to pay back the $1500.00 which the company advanced, and they have finished each year since that time with approximately the same amount on the right side of the ledger. This in view of the fact that the lunch room is not operated primarily for profit, and food is served at prices much lower than average restaurant quotations.

The Ayres lunch room opens for business at 10:45 a. m. and serves lunches until 2 p. m. Upon occasions they also serve evening meals to those employees who are putting in overtime. The restaurant is patronized regularly by more than 70 per cent. of the employees. In this way the workers come to know each other better, and a wholesome spirit of good-fellowship prevails.

Within a few months the Ayres employee-owned lunch room will celebrate its seventh anniversary. From the worker's standpoint it has been an unquestioned success. The company, too, is well satisfied. Frederic M. Ayres, president of the institution, said recently: "The restaurant has done more than any one factor to keep our workers contented. *And it has eliminated costly tardiness at noon.* Before we started the restaurant, many of our employees endeavored to go home at noon for a warm meal, with the result that they drifted back perhaps half an hour late. Now they do not have to leave the building



"We Have Several of These Furnaces

in operation during the winter season and assure you that they offer excellent heating service. We have burned wood, soft coal, and coke in these furnaces with satisfactory results."

This statement, written by a Wisconsin foundryman, is like many others in our files. His satisfaction is due to these definite reasons:

1. Costs less to install than indirect heating systems and uses up to 50% less fuel.
2. Direct-fired. Burns economically either hard or soft coal, coke, oil, or gas.
3. Keeps the heat in circulation near the floor instead of allowing it to waste upward.
4. Simple construction. Ordinary mechanic and helper can assemble it in a few hours.
5. Can be operated by anyone who can swing a shovel. Does not require the attention of a skilled engineer or boiler-man.
6. No steam or drip pipes to worry about. Nothing to freeze up.
7. Extended surface fins on the fire pot and the thin rings on the tubes provide a maximum heat radiating surface.
8. Over-all efficiency is 81% by official test in the laboratory of the Armour Institute of Technology. More than double that of any other type of heater.
9. Recommended for drying clay products, asbestos, magnesia, tobacco, cereals, vegetables, textiles, and all other products dried by warm air up to a temperature of 400°.

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B. F. STURTEVANT COMPANY, Hyde Park, Mass.
Gentlemen: Please send the Hot-Blast Heater bulletin 306.

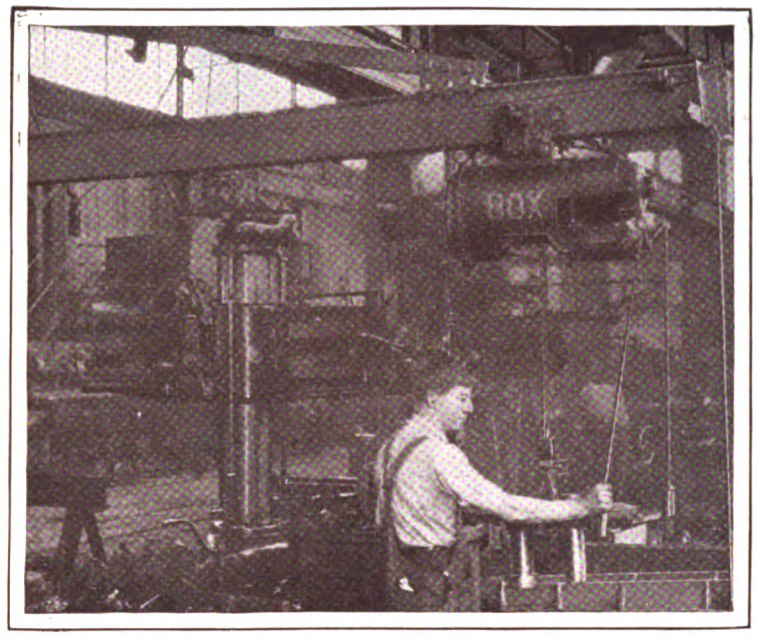
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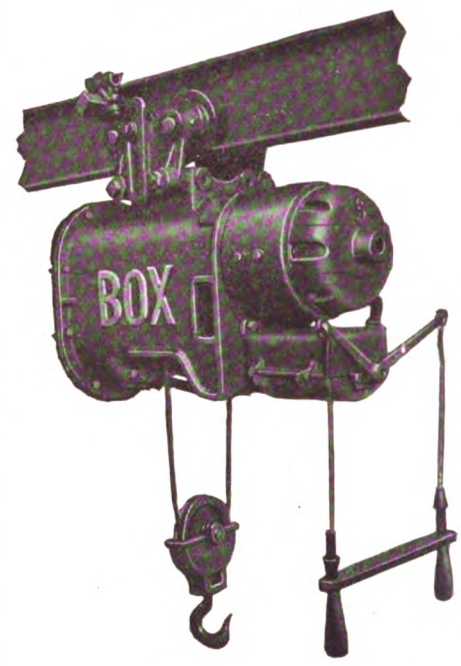
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. They are better sat-
d so are we."
difficult to strike a
average in the prices
at various employee
oms. Prices vary widely
fferent conditions, and
nt parts of the country,
being always to serve
holesome food, at the
ossible prices. Most of
afeterias now serve a
l table d'hote meal, com-
f soup, meat, vegetables,
nd butter and dessert.
neral run of prices is
to 35 cents for the meal,
possible average of say
s. In addition to this
d meal, many of the res-
s maintain a la carte

e these employee lunch
are not designed pri-
as money-making in-
ns, many of the well-
ed cafeterias do show fair
even at the prevailing
ices. This usually is due
elimination of rent, light,
nd similar factors which,
er with overhead, com-
a large part of the usual
rcial restaurant expense.
ustomary to give the em-
s the benefit of these res-
it earnings. Usually the
is turned over to the
l benefit association, the
tion fund, or some similar
ial activity. I know of one
where funds from a res-
nt have been accumulating
nore than five years. The
oyees are planning to invest
money in a club house, which
be located at a nearby re-
At this club the workers
members of their families
be privileged to spend week-
and vacations.
most cases, the lunchroom
leges are restricted to em-
ees of the factory, shop or
. There are instances, how-
where a factory has ex-
ed this service to include
workers in other nearby
ts, thus reducing operating
s. And I know of one place,
east, where the general pub-
is invited. The factory of
Steger Piano Company, at
ger, Illinois, is located on a
l-traveled motor road. The
pany, by the use of attrac-
signs, extends an invitation
the motorist to stop and dine
the employees' cafeteria, con-
ding that the advertising thus
ured more than offsets the
ssible loss entailed in serving
ese outside guests.
In the matter of locating the cafeteria there is a general unanimity of opinion. A large majority of companies prefer to have it located in the main factory building, in as central a place as possible, so that employees will lose no time in going to and from lunch. Here again, however, I call to mind a notable exception. And that is the Columbian Rope Company, of Auburn, New York. Although the main plant of this company covers more than a million square feet of ground, in planning a cafeteria, the executives deliberately refused to consider a location in the plant itself, and erected a beautiful building across the street, to be used for this purpose. The company then went a step farther and issued a ruling which forbids any employee to eat his noonday meal within the shop. "We wanted them to get clear away from the place for awhile," one of the officers explained. "We felt that the morale and the health of the workers would be greatly improved if they broke the monotony of a day's work by a complete change of scene." The



LOAD LIFTER



WHEREVER efficiency, speed, steadiness and economy in lifting or shifting are needed, the "Load Lifter" is found. Their predominant use by the industries is well known. Their sturdy construction, ease of handling, low cost of operating and elimination of extra lifting squads show unmistakably in figures. The harder the work and the heavier the going, the more marked is the showing.

* * *

Alfred Box & Company, Inc. have had a very broad experience in the problems of load lifting for both big and small concerns. They never urge an installation which does not promise a profit to the owner.

INVESTIGATE how the Load Lifter can be operated in your business—how it will cut costs and quicken production. Important data and Bulletins on the subject will be sent upon request. Ask your Secretary to send for it now.

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BOX CRANES
ALFRED BOX & COMPANY, INC. PHILA. PA.
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Automatically lubricated from one point.
Working parts operated in bath of oil.
Positive Forced Feed Lubricating System reaching all points.
Totally enclosed construction.
Hyatt Flexible Roller Bearings.
Ball bearing motors.
Forged Steel Heat Treated Stub Tooth Spur Gears.
Manganese Shafts.
Nothing to adjust.
Perfect control.
Small—but very powerful.
Adjustable Trolleys.
Interchangeable Upper Hook and Trolley.
Permanently aligned bearings.
Simplified Rope Anchorage.
Extremely accessible.
Interchangeable parts.
Every bolt a fitted bolt.
Fine workmanship throughout.

* * *

Alfred Box & Co., Inc., are also builders of the "Box Crane"—a standardized, heavy duty, Electric Traveling Crane in capacities of twenty tons and under; also builders of hand operated Traveling and Jib Cranes of any capacity. In addition, full line of Electric Hoists to five tons capacity—embodied in which are all the important features found in the "Load Lifter."

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company is thoroughly satisfied with the way its plan is working out.

The size and equipment of a cafeteria depend, of course, almost entirely upon the number of employees to be served. In some very large plants a number of small lunch stands are operated. The United States Steel Company, for example, operates 73 lunch rooms at one of its plants. The Westinghouse Electric Manufacturing Company, on the other hand, restricts the food service at its great East Pittsburgh plant to a single building which has the distinction of being the largest eating place in the world for civilians. This three-story building seats 3200 persons at one time.

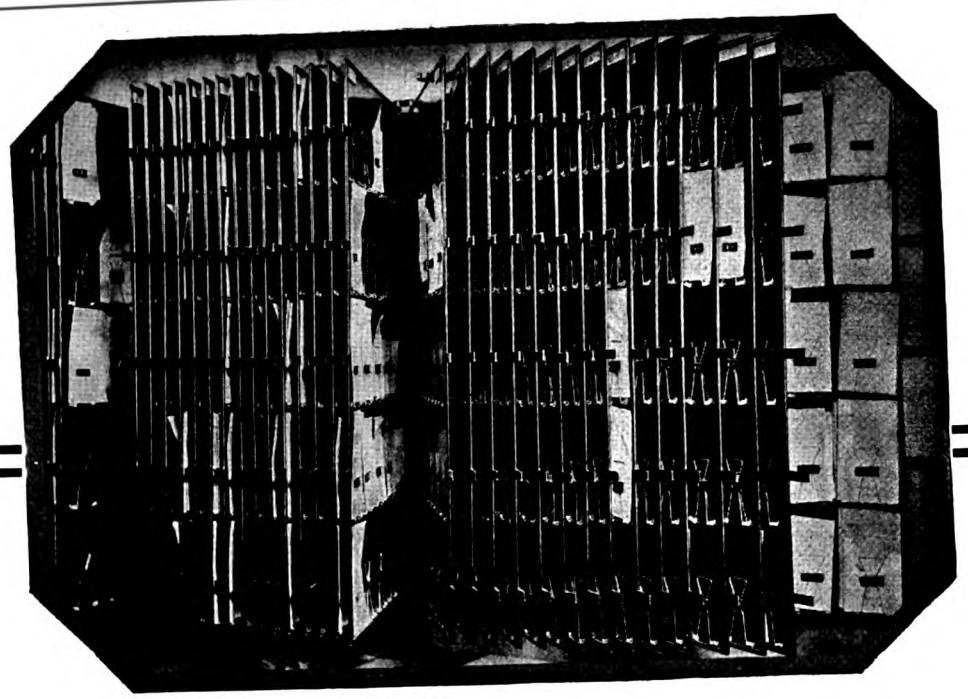
At the Westinghouse plant, by the way, there is an ingenious "speed up" device that has worked out very well, indeed. Moving belts are placed in front of the serving counters. Trays are placed on this belt instead of sliding them along the rail in the usual maddeningly deliberate way. It would be possible, of course, to hold the tray stationary and let the belt go its way, but the company finds that the general tendency of a diner is to keep pace with the moving belt.

The motorman in charge of this device says that he can accelerate the belt 25 per cent., and rush the line through during busy periods. Thirty-four persons per minute can be served, and this is perhaps 50 per cent. faster than the average speed in cafeterias. At the Westinghouse lunch room, the average check for girls is 17 cents, while the men require 37 cents' worth of grub to appease the gnawing pangs of hunger. It should be pointed out, however, that many of the girls are office workers, while a good percentage of the men are engaged in heavy manual labor.

A rather ingenious plan has been worked out by the Edward G. Budd Manufacturing Company. The company did not have space for a central lunch room, so devised the plan of having a canteen on each floor. These canteens take up only about 60 square feet of space. The men stand in line and are served through a "cashier" cage door. In one of these canteens 250 men have been served in eight minutes. There are no tables, chairs or unoccupied floor space. The men take their food as it is handed out to them and eat at their workbenches, or elsewhere in the building.

The Budd plan, although successful, is not recommended for general adoption.

In physical appearance employee cafeterias range from barren, barn-like rooms, with rough wooden tables and benches, to the bright, cheery, tastefully decorated quarters, which the telephone companies and other large employers of women almost always provide. Experience has proved conclusively that a little money spent in "fitting up" a lunch room is invariably a good investment. I recall the case of a department store in the Middle West that "anything will do" for the employees' lunch room. They took a depressingly dreary basement room, piled in a lot of cheap, rough fixtures, and started in business. The result was that less than 10 per cent of the workers patronized the place. Later the store learned better, spent a few hundred dollars in beautifying the lunch room, and now a large majority of the employees eat there every day.

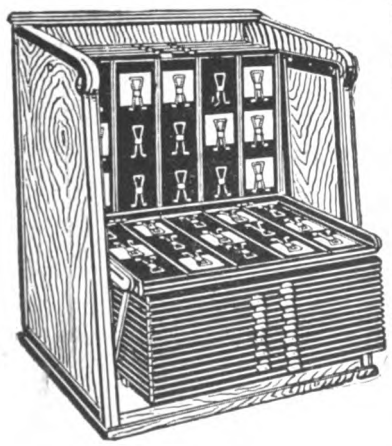


100% on Delivery Promises

Since They Installed a McCaskey

You know how important deliveries are in keeping customers. You know how important it is to be able to promise delivery on a definite date and then to keep that promise. Yet how many firms can do it? One firm, Lipson and Adelson, manufacturers of Peggy Paige Clothing, has found a way. Mr. S. Frindel, Jr., Ass't. Sales Manager, says:

"Practically 100% on delivery promises is the outstanding result of our installation of McCaskey equipment. Particularly in our business which involves 16,000 classifications of dresses that must be handled in lots of one, two or three, proper production control here is no small matter. But the McCaskey has made it possible.



"We have 12 manufacturing departments in which production must be put through on schedule. When a cutting order is made out, it is filed in the McCaskey board together with the requisition for piece goods and trimmings according to the department which is to manufacture the order. As the piece goods and trimmings are delivered, they are checked off on the requisitions, and as the finished dress comes in from the department, it is checked off on the order.

"In this way, an indisputable aid is given us in following production in the different departments —and in insuring prompt deliveries to customers. After the cutting order is issued a tag is made out for the dress. This tag is in three parts, the first is attached to the dress, the second goes to the receiving department with the dress where it is detached and sent to the production control department, and the third is filed in the McCaskey when the tag was made out—and shows the scheduled delivery. A glance at the board shows which dresses are behind scheduled delivery.

"By means of the McCaskey we have kept production up to our ever increasing orders."

And in Your Plant---

You, too, no matter what your business may be, can have the benefit of an ever increasing number of satisfied customers by installing a McCaskey System designed for your needs. In hundreds of plants McCaskeys are keeping stock records, cost records and production records—are checking orders, keeping daily inventories and doing similar work. It is no trouble to find out what a McCaskey System will do in your business. Write us.

THE McCASKEY REGISTER CO.

McCASKEY ONE WRITING SYSTEMS

Industrial Division — *Alliance — Ohio*

CANADIAN PLANT — *GALT, ONTARIO*

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In many instances one of our standard types (hand or electric driven) fitted the job exactly. In other places we built a special machine to suit the conditions and requirements.

It will certainly pay you to study the adaptability of the DELTA to various handling jobs—then, make a note of the many places in your plant where a DELTA can save the labor of two to twelve men, eliminate the use of ramps between difficult floor levels, expedite the handling of materials between floor and mezzanine, save demurrage by speeding the handling of freight to waiting trucks and save labor and handling costs on many other jobs.



The New DELTA Features

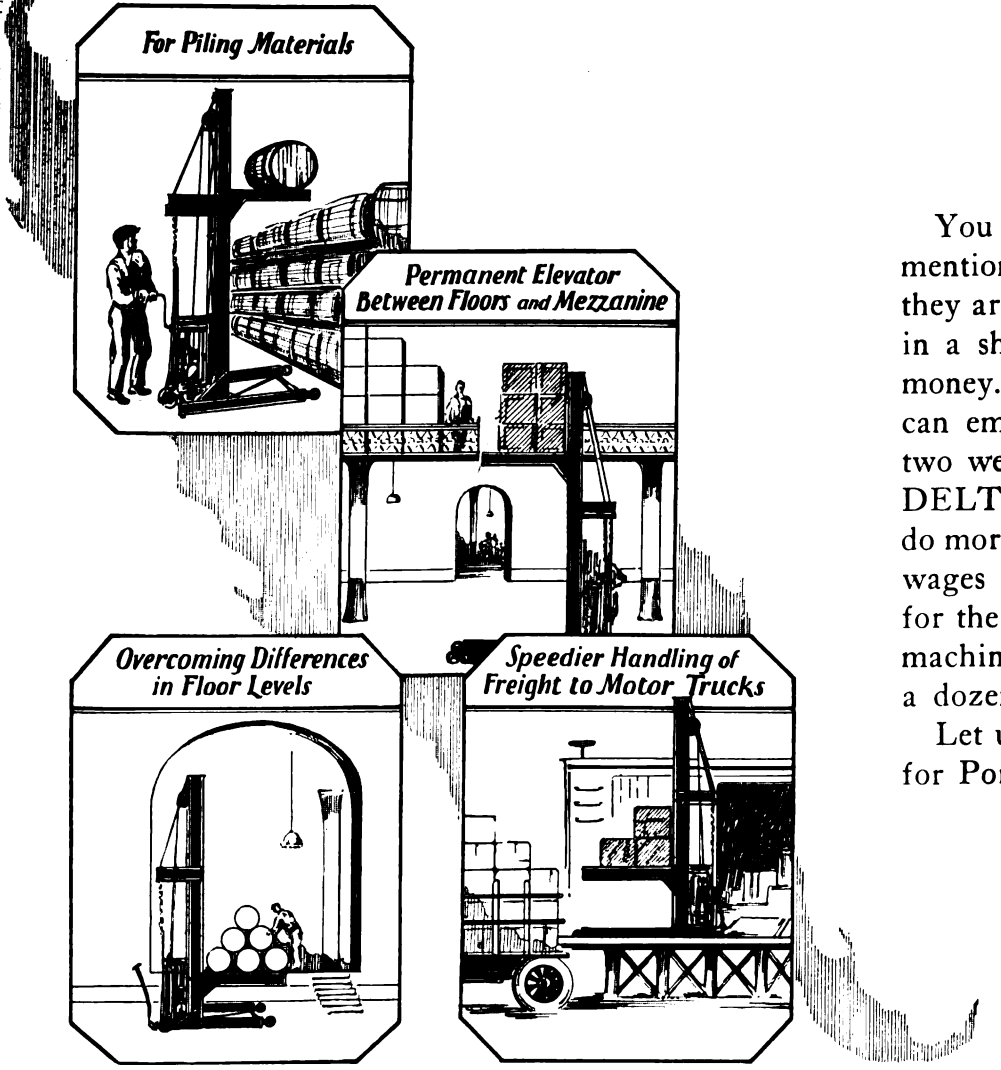
AUTOMATIC ELECTRIC BRAKE—locks when circuit is broken by controller, limits, low voltage or failure of current for any reason.

AUTOMATIC ELECTRIC UPPER AND LOWER LIMITS—that break the motor circuit locking the brake, when platform reaches high or low position.

REVERSING TYPE HOIST MOTOR—controls lowering speed.

SIMPLE OPEN ARRANGEMENT OF PARTS AND UNITS—no adjustments requiring mechanical knowledge.

TWIN DRUM, TWIN ROPE—eliminates side tipping of extra wide platforms.



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Making Labor Appreciate the Labor-Saving Idea

(*Continued from page 28*)

burdensome tasks which are now being performed by the more ignorant classes of labor will be performed by machinery, and when the laboring man becomes fully acquainted with machinery and what it does for him he will refuse to accept a job unless machinery is provided to help him in the more difficult tasks.

Some of the more progressive industrial plants are beginning to realize that their best interests demand that they do more than equip their plants with labor saving machinery. They must also make an effort to sell the idea of the use of labor saving machinery to the men, convincing these men that machinery is not their enemy but their friend. If good, genuine, honest effort is made to get their men to look upon labor saving machinery in the proper light, a change in the attitude of the men will be noticed themselves must be that the labor saving is a good thing for the owners and operators dustrial plants can ex- all out of labor saving ery that there is in it.

While visiting the one of the largest wire the country the writer formed that the em- this mill were demanding chinery to handle the bundles of wire which handled for the past by manual labor. It the custom in this require the men in drawing departments 300-pound bundle of reel and to remove it block after drawing with aid of machinery. The tion required one man 300-pound load twice ev- ute for eight, ten and hours per day without of machinery of any kind.

It is not long since in this industry objected ously to the use of any labor saving machinery felt that the introduction chinery meant the loss jobs.

As a contrast to the of the men in the wire hear of the stevedores Orleans going out on as a protest against the an overhead Tramrail designed to take a cargo from the cars and ware and lower it into the boats. These men insist the use of the more primitive method of cargo with a ship's rig and ging it by manual labor resting place in the hold boat.

A few years ago the erection of a large factory in land was tied up with because the plumbers, fitters and electricians would use a pipe cutting and thread machine that was provided the owner of the building der to get the building com- as soon as possible.

There can be no question what it will be only a matter time until these same unions possibly these same men will mand a pipe cutting and thread- ing machine on every building. The cutting threading of pipe is no task.

(*Continued on page 62*)



The Value of Standardized Shelving

The Joseph Berlinger Company, Silks, of New York City, needed storage facilities immediately. The present arrangement was only temporary because the stockroom was to be re-arranged in the near future.

The new layout of the stockroom would require an entirely different arrangement of the racks. The spacing of shelves and dividers would change. Additional parts would be needed.

Here was a case where the shelving installation must meet immediate requirements—and at the same time be adapted easily and quickly to future plans.

It is a splendid illustration of the value of standardized shelving.

Selection of Lyon Commercial Shelving followed naturally because all parts are standardized and interchangeable. It will be a simple matter for the Joseph Berlinger Company to adapt this shelving to the new arrangement of their stockroom. Orders for additional parts can be filled without delay from our warehouses at Aurora or New York City.

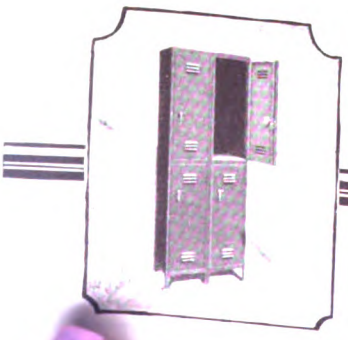
Applying Lyon products to our customers' needs as here—and building only the best products we can build have brought a high prestige to Lyon Steel Products.

Your stores problem may be needing a Lyon sales engineer. It costs you nothing to get his recommendation. He is capable of not merely recommending a particular shelving to you, but of laying out a complete storage plan for you.

Through him, our experience of years is at your service. Please address our main office.

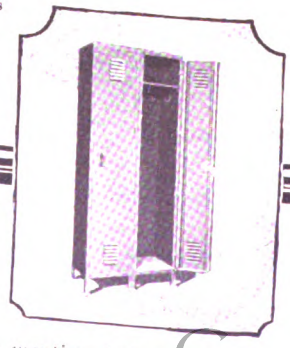
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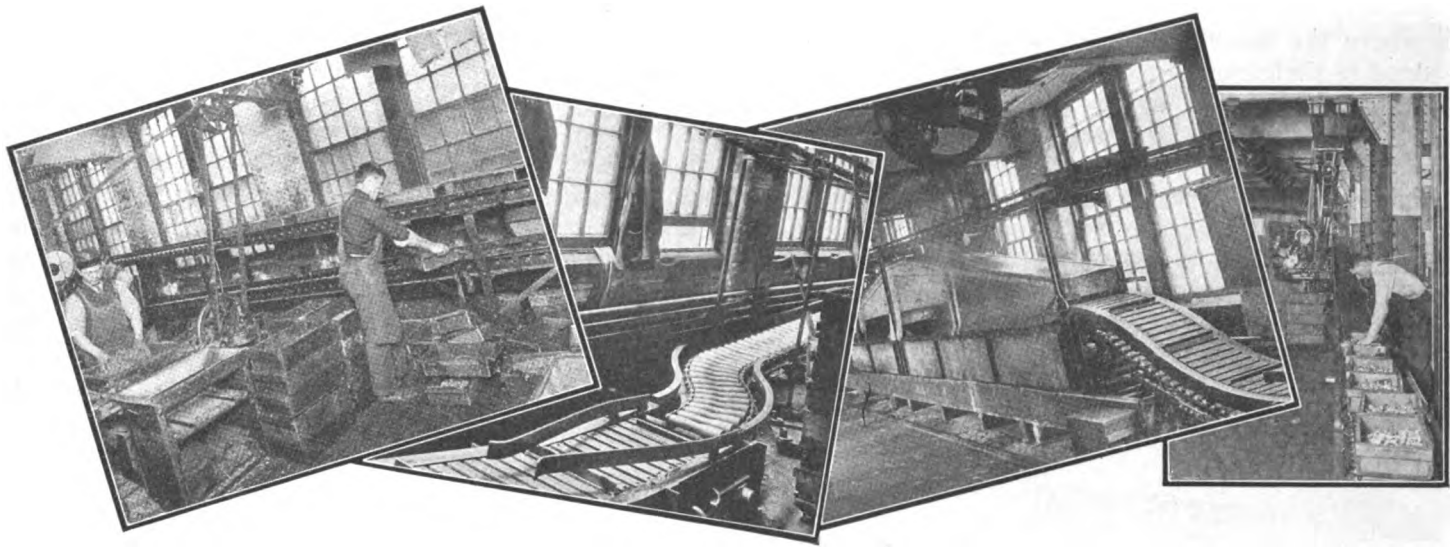
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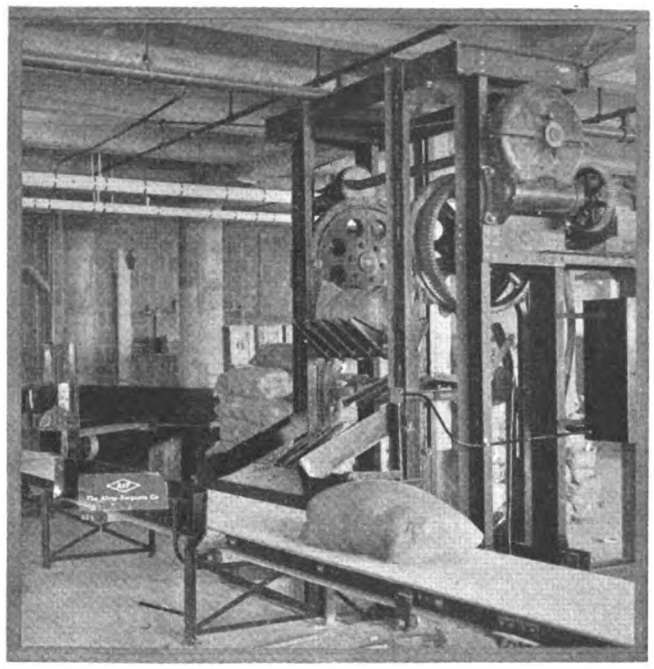


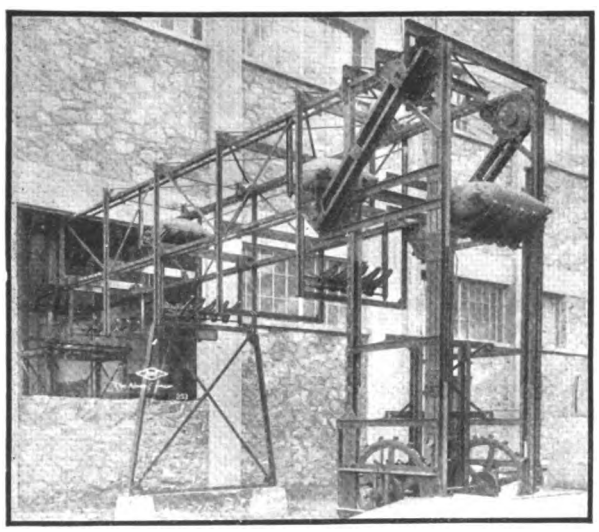
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A-F CONVEYORS are a victory over the problems of industrial transportation. And their economy is not limited to the handling of one or a few specific types of packages or products. If you could visit some of the hundreds of plants A-F equipped, you would find products of widely varying weights, shapes and sizes being handled with absolute satisfaction.

Our Engineering Service Bureau stands ready to study your particular requirements and assemble the various conveying units best suited to the exact work at hand. You do not have to guess when purchasing A. F. Conveyors. You know their true value in *your* plant before you buy. The assistance of Alvey Ferguson Engineers is yours without cost.

The Alvey-Ferguson Co., Inc.

Cincinnati, Ohio

BRANCH OFFICES IN PRINCIPAL CITIES

A TRADE MARK F

CONVEYING MACHINERY

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Making Labor Appreciate the Labor-Saving Idea

(*Continued from page 28*)

burdensome tasks which are now being performed by the more ignorant classes of labor will be performed by machinery, and when the laboring man becomes fully acquainted with machinery and what it does for him he will refuse to accept a job unless machinery is provided to help him in the more difficult tasks.

Some of the more progressive industrial plants are beginning to realize that their best interests demand that they do more than equip their plants with labor saving machinery. They must also make an effort to sell the idea of the use of labor saving machinery to the men, convincing these men that machinery is not their enemy but their friend. If good, genuine, honest effort is made to get their men to look upon labor saving machinery in the proper light, a change in the attitude of the men will be noticed. The men themselves must be convinced that the labor saving machinery is a good thing for them before the owners and operators of industrial plants can expect to get all out of labor saving machinery that there is in it.

While visiting the plant of one of the largest wire mills in the country the writer was informed that the employees of this mill were demanding machinery to handle the 300-pound bundles of wire which have been handled for the past fifty years by manual labor. It has been the custom in this industry to require the men in the wire drawing departments to place a 300-pound bundle of wire on a reel and to remove it from the block after drawing without the aid of machinery. This operation required one man to lift a 300-pound load twice every minute for eight, ten and twelve hours per day without the aid of machinery of any kind.

It is not long since the men in this industry objected strenuously to the use of any kind of labor saving machinery. They felt that the introduction of machinery meant the loss of their jobs.

As a contrast to the attitude of the men in the wire mill we hear of the stevedores at New Orleans going out on a strike as a protest against the use of an overhead Tramrail System designed to take a cargo directly from the cars and warehouses and lower it into the hold of boats. These men insisted upon the use of the more or less primitive method of hauling cargo with a ship's rig and dragging it by manual labor to its resting place in the hold of the boat.

A few years ago the construction of a large factory in Cleveland was tied up with a strike because the plumbers, steam fitters and electricians would not use a pipe cutting and threading machine that was provided by the owner of the building in order to get the building completed as soon as possible.

There can be no question but what it will be only a matter of time until these same unions and possibly these same men will demand a pipe cutting and threading machine on every large building. The cutting and threading of pipe is no easy task.

(*Continued on page 62*)



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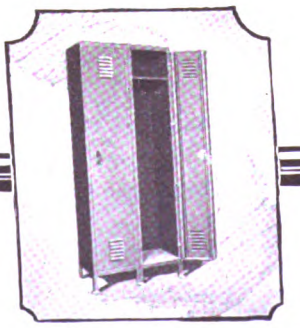
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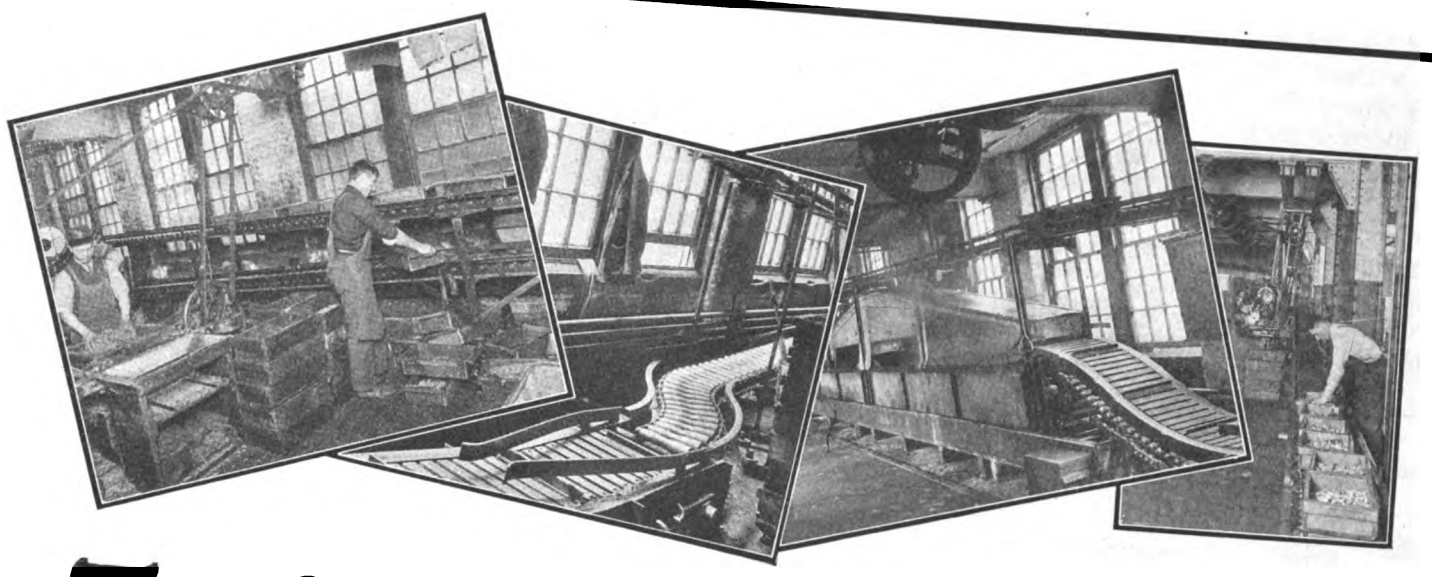
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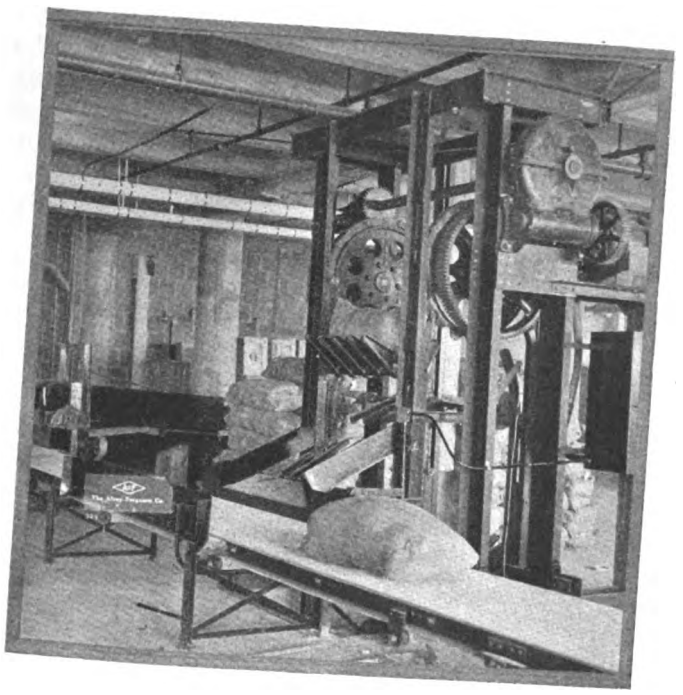


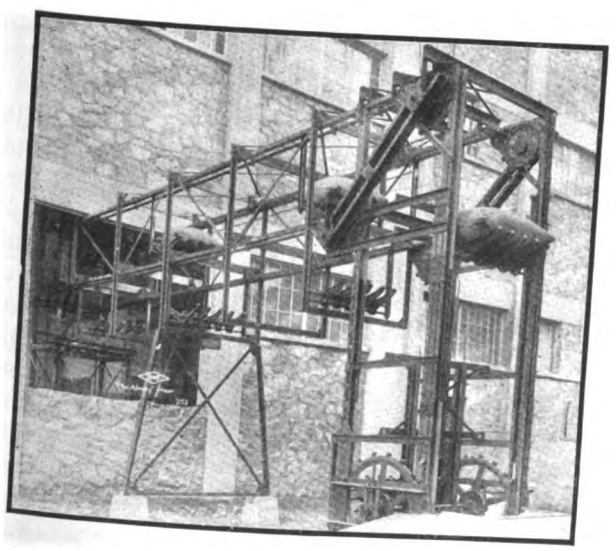
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OVER these trails millions of dollars in American products pass each year. With practically no cost for power and upkeep they do their work with greater efficiency than any other known method or equipment. They never tire. They need no light to guide them. They ask nothing for their service save a little power and occasional inspection. They go over buildings, through narrow passages, under road-ways and yards, through walls, and into many places where truckers could not work.

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(*Continued from page* 60)

Instances without number could be cited where the laboring men have stood in their own light in objecting to the use of machinery and in nearly every case the responsibility for the failure of the laboring man to look kindly upon the use of machinery rests with his employer. If the employer attempts to thrust machinery down the laboring man's throat, he can expect difficulties sooner or later.

In every case where labor saving machinery is installed the employer should see to it that the men themselves are in favor of the use of the machinery. They should be given to understand that the world is continuing to progress and that the time will undoubtedly come when all of the disagreeable and burdensome tasks are removed from the shoulders of the laboring man.

The last fifty years has seen more new machines developed and more disagreeable tasks removed from the shoulders of men than has been made in all our previous history.

If we would look back and see the progress which has been made in the past thousand years the results would be surprising.

In discussing the evolution and progress of a sailor's job with an old sailor, the writer was not surprised to find that the old gentleman felt that the world was going backwards. He stated that the days when he was on the sea, thirty years ago, were the days of wooden ships and iron men, and that today is the day of iron ships and wooden men, but if this same sailor were to look back a thousand years he would find that the sailors in those days worked in the galley on the short end of a long oar and that eight-hour days were unknown to them.

Only five years ago the washerwoman looked with jealous eyes upon the increasing popularity of the electric washing machine and today it is practically impossible to obtain a washerwoman in any of the larger cities unless an electric washing machine is provided.

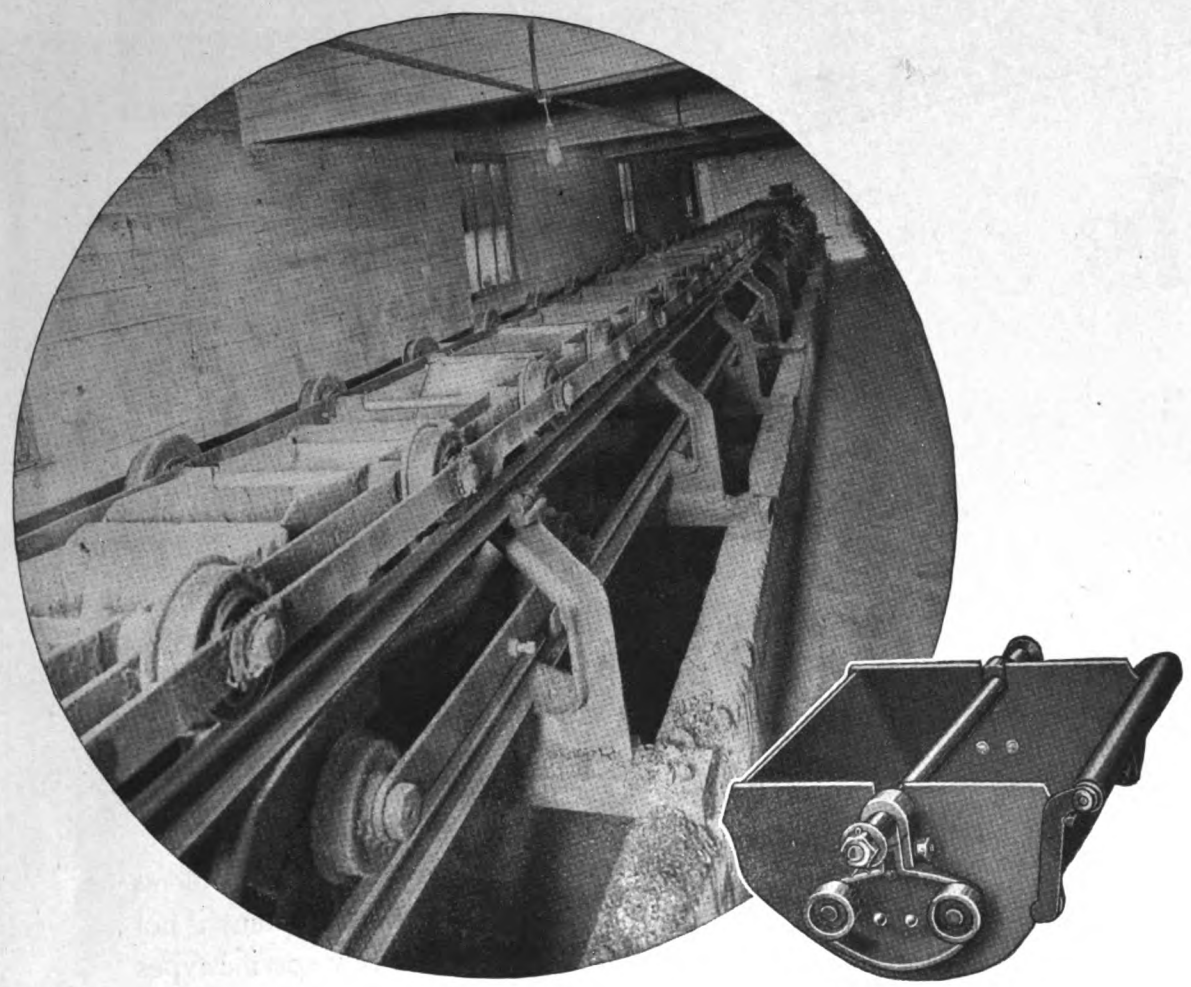
The laboring man of today must be made to realize that for the past thousand years machinery has been slowly but surely removing or reducing the loads on their shoulders.

The men who are truck drivers today carried their loads on their backs a thousand years ago and they were not light loads either.

The men who are taxicab drivers today carried their passengers in baskets suspended on long poles a thousand years ago. Speeding was an effort in those days.

A thousand years ago the galley slaves undoubtedly objected to the application of sails on their boats as they felt that the use of sails would take away their jobs. They did not realize that the application of sails was the best thing that could happen to them because they were automatically advanced to a higher position in life not through any effort of their own, but because what was possibly the meanest job on earth was eliminated by a form of machinery and they had to get out and find a higher job whether they wanted to or not.

So it is today, machinery is continuing to eliminate the "meanest jobs" on earth and the men who are now occupying these jobs are automatically advanced to a higher position in life whether they want this advancement or not.



If You Could See

THE Perkins Pivoted Bucket Carrier At Work—discharging a continuous stream of coal on the upper run and ashes on the lower run of conveyor—at a tremendous saving of man power—

YOU would clearly understand the great preference for this ideal, economical conveyor. Your first impression will be quickly confirmed when you see how perfectly this bucket carrier works in the boiler room.

The Perkins Pivoted Bucket Carrier handles both coal and ashes with low operating and maintenance charges. It does the work mechanically releasing labor help for more profitable work.

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The Question of Crating

(Continued from page 21)

been using a low-grade hardwood for the crate because it was cheap and had not realized that this was piling up 2,000,000 pounds of unnecessary weight annually upon which to pay freight.

Another manufacturer is saving $30,000 a year by the use of a re-designed crate for one export item, the saving being represented by a saving in lumber, a saving in labor and a tremendous saving in water transportation, where unnecessary bulk in a package brings a high penalty. During the war the re-designing of a cartridge case saved the Ordnance Department of the Government $50,000 on the first contract, besides saving $100,000 in cargo space.

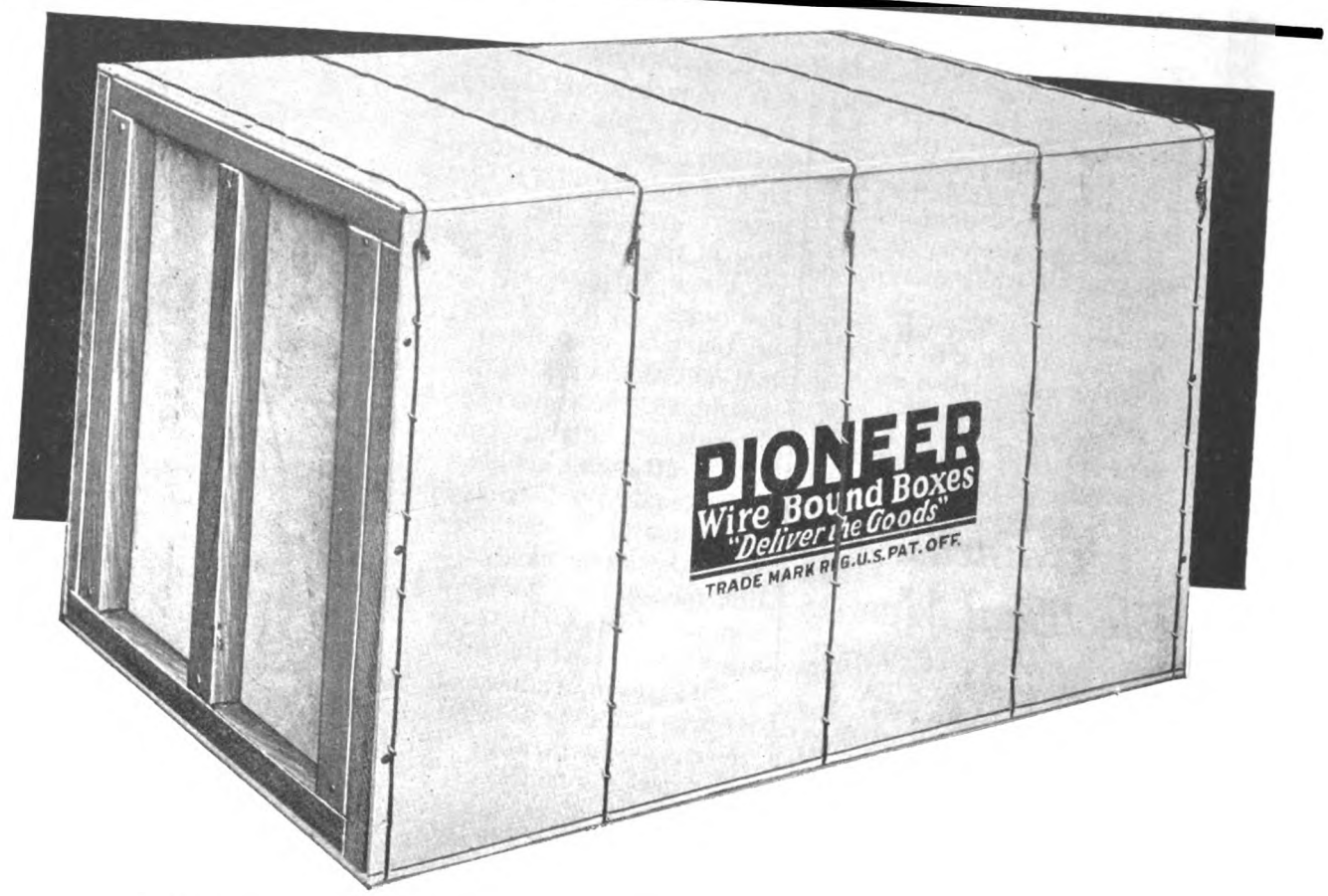
In one plant, improved design and a change in the dimensions of some of the timbers saved 52 per cent. of the lumber in a crate for an automotive axle and made the package 112 pounds lighter. Yet, due to the improvements made, the new crate was stronger. A new crate for a washing machine saved 11.9 feet of lumber and 39 pounds in shipping weight, and a plan of building it in sections enabled workmen to build it in half the time required for the old crate.

Instances might be piled up at length, cases where re-designing of crates is saving manufacturers all the way from 10 to 50 per cent. of the lumber formerly used, making consequent large reductions in freight bills and cutting down on the labor required.

Using less lumber, the engineers in many cases can give the goods much better protection. Scientific crating, according to the engineers, will stop much of the damage to goods now incurred in shipment. Railroads pay out $100,000,000 a year in claims for lost and damaged freight, a large part of it due to improper packing. Tests made by the United States Forest Products Laboratory tend to bear out the conclusion that most of the damage to goods received in shipment can be eliminated with proper care by shippers, and packing engineers have shown that in very many cases it actually can be done by using considerably less lumber.

For illustration, take the matter of diagonal bracing, the lack of which is responsible for the failure of many crates. A crate that is properly braced diagonally will stand twice the force that would ruin an unbraced crate when dropped on a corner. Likewise, the three-way corner adds tremendously to the strength of a crate, the corner being the weakest part of the ordinary crate. And so with other devices which can be employed.

Aside from saving waste, good packing has a tremendous value from a merchandising standpoint. The dealer who is waiting for an order of goods for an impatient customer and finds the goods so badly marred on arrival that they cannot be sold isn't going to have a very good impression of that particular manufacturer. Little things often, like the use of nails that are too large or some such slight error in crating, can have far reaching effect in destroy-



What the Pioneer Wirebound Box means to you

THE cost of shipping is a matter of increasing interest to manufacturers. The heavier-than-necessary box, the lighter-than-needed box, the broken box, the easily-pilfered box, the one-trip box, the poorly-designed box are items of waste that place a heavy tax on industry.

To you Pioneer Wirebound Boxes and Crates mean the elimination of this burdensome tax—if they can be adapted to your product. Pioneers are made in many sizes and shapes. They are used by manufacturers in many different industries. Likely you, too, can use them.

On your request we will be glad to send a General Box Engineer to study your requirements and design a Pioneer to suit your needs. This will place you under no obligation of any sort.

Pioneers give your goods maximum protection at a surprisingly low cost. Stronger and lighter than nailed wood boxes, they cut lumber waste and save transportation charges.

Made of tough rotary-cut lumber and bound with strong steel wires, they are practically immune to the destructive shocks and strains of shipping. Fastened and sealed against theft in one operation.

Pioneers are delivered to you in flat folding form and three-fourths assembled. Save storage space or assembling costs.

Your customers appreciate receiving shipments in Pioneers, for they can open Pioneers just by clipping the wires. The top throws back, making it easy to unpack. By splicing the wires—a simple thing—the box is ready for reshipment.

Write for General Box Service—a booklet of information on better boxing and crating methods.

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"Cooke Trained Men KNOW Electricity"

ing good will. The man whose goods come in a nice package holds his customers, and payment of his accounts is not delayed while adjustments are being made.

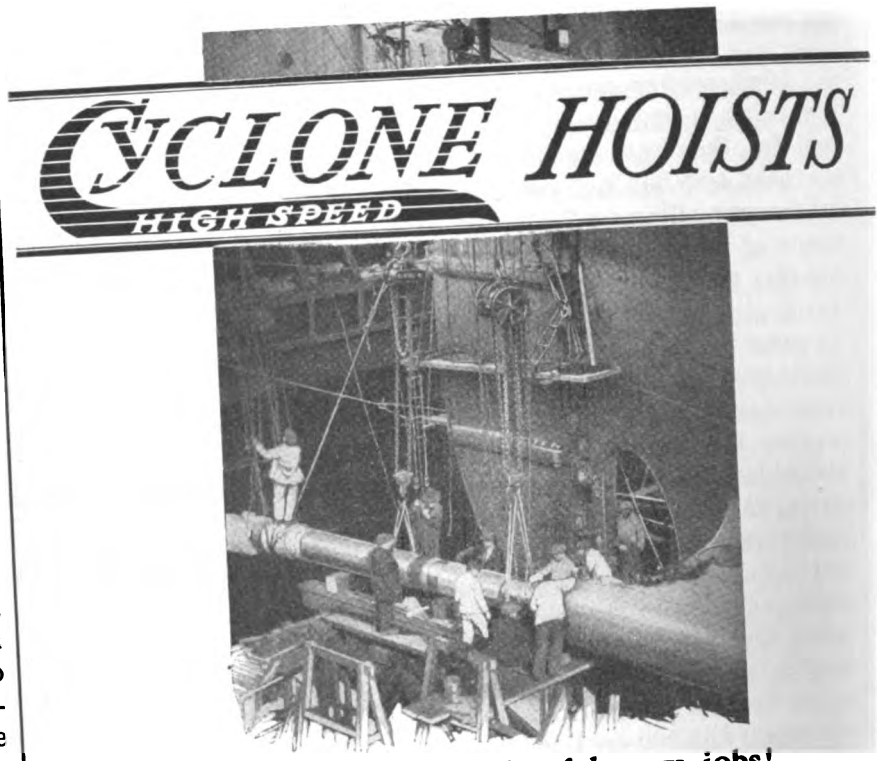
But good packing is more than designing a container. The manufacturer, if he is going to do the job in a really scientific way, must take into consideration the nature of his product, trade practices, habits of his customers and a score of other things. Failure to follow the question to its bottom may prove disastrous.

A manufacturer of furnaces, sending out his goods to retail dealers, found it convenient to pack a number of furnaces together, putting parts of one kind in the same crate. To assemble a furnace, the retailer had to get one piece from twelve or fourteen crates. After he had got one or two furnaces assembled, the remainder were a confused mixture of parts and crates in his basement. This dealer no longer handles this make of furnace.

On the other hand, the solution for another shipper's problem was to put six truck radiators in one crate instead of crating each radiator singly. He was shipping to a manufacturer who naturally used the radiators in quantities.

The work of the packing engineers has done much to increase interest in correct crating, and in many cases shipping practices of big industries have been changed radically as a result. It is unusual to see a big lumber firm hiring engineers and sending them out without any charge to help shippers improve their crates and get along with less lumber, but it will be admitted readily that it is good merchandising. At the same time, it represents a very practical step in conservation. While everybody is talking about conservation, here is a kind of conservation, of which shippers can take advantage right now, and to their immediate profit, too.

By applying proper methods of construction, reports the United States Forest Products Laboratory, it is estimated that from 25 to 50 per cent. of the lumber required for boxes and crates can be saved. That means two to three billion feet annually, and is at the same time a good illustration of one way to reduce freight bills.



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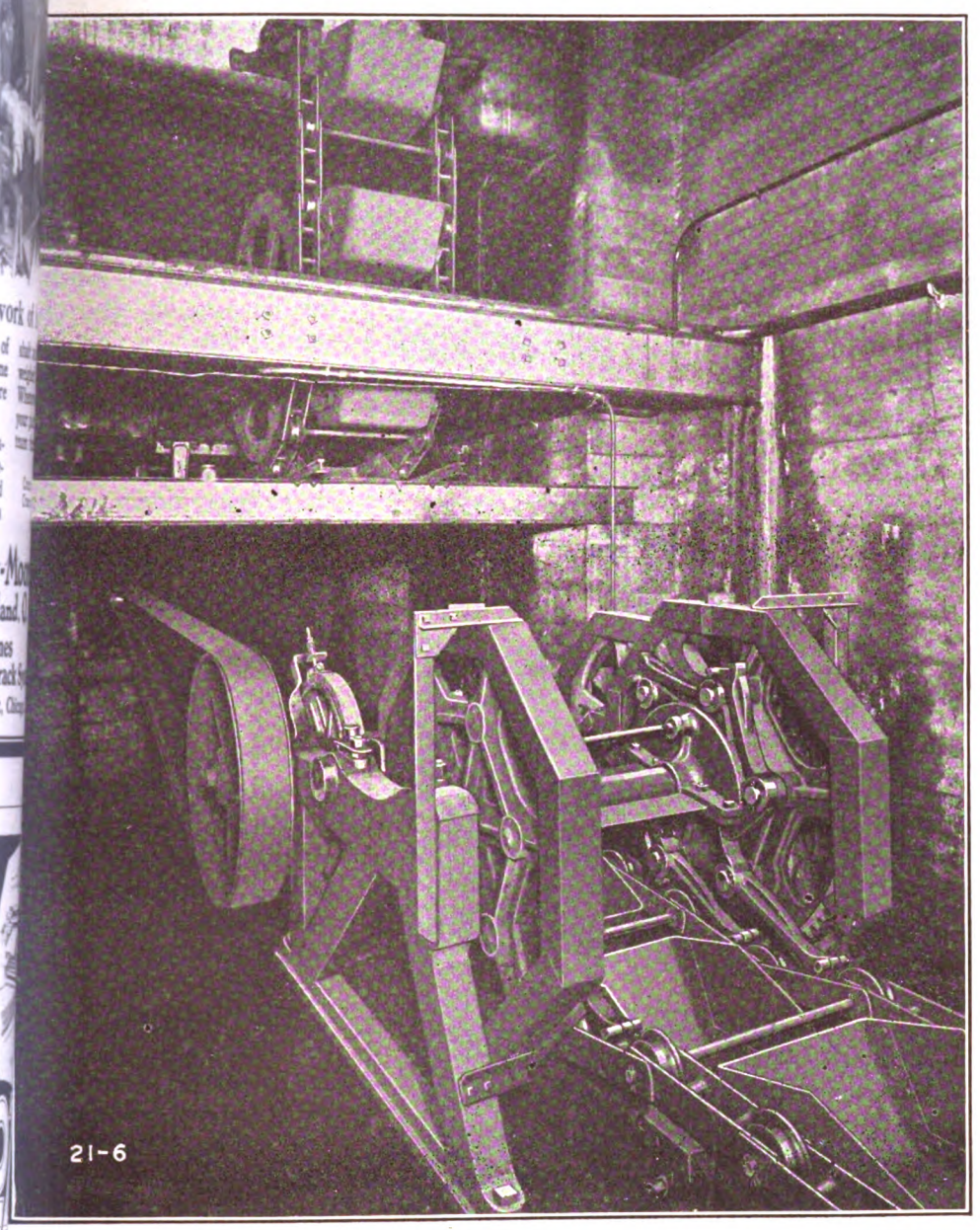


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STUNTED VISION

"Many industrial executives keep their noses ***so close to the grindstone*** *of production that they fail to see that the stone* ***needs dressing or that the*** *belt which drives it is slipping."*

From an editorial in Industrial Management, November, 1923



The Hunt conveyor is driven by a Hunt Standard Pawl Driver, consisting of a number of pawls driven by a gear wheel. These pawls are of cast steel and engage with the studs between the links on each side of the conveyor, giving a smooth, even and continuous motion to the chain. This method of driving on studs in chain relieves wheel bearings from the driving strain to which they are subjected with other types of drivers. As the end of the pawl **rolls** on the stud, no wear occurs at this point, and any variation in the pitch of the driving studs, due to wear in the links, such as is bound to occur in a conveyor with vertical lifts and after long operation, does not affect the evenness of the movement. This is a distinct improvement over sprocket drives where constant pitch is essential to satisfactory operation. Behind the cross beam is shown a Hunt Revolving curve by which change of direction of chain is accomplished.

We quote further from this pithy editorial, "Keeping the Plant Fit for Profits!":—

"Concentration on production is admirable and effective, provided we are organized to concentrate likewise on the things that keep production going."

While this editorial was written primarily to induce better care of plant and equipment, we use it in a broader sense to cover not only the object for which it was intended, but also as applying to the initial installation of equipment as well.

Too much care cannot be exercised in the selection of all apparatus intended for the equipment of the plant; for "breakdown insurance protection" is dependent in as large a measure on a wise *selection* of apparatus, as it is in the proper *maintenance* of the apparatus after it is installed.

In the matter of coal and ashes handling, or the handling and rehandling of other bulk materials, the equipment for performing these functions should represent the highest type of their class; in which ruggedness, freedom from serious breakdowns, low upkeep and long and satisfactory service under all conditions are the dominating features.

Over half a century ago C. W. Hunt conceived and developed a number of devices destined to lessen the labor and cost of handling coal, ashes and other materials in bulk; to move them with rapidity and safety and effect greater economies in boiler-room and plant. He built well; laying particular stress on the workmanship and material entering into their construction.

Today, there exists Hunt Cost-Cutting Equipment that has withstood the severest kind of service for from eighteen to thirty years, with only minor repairs. Which proves conclusively the ruggedness and reliability of Hunt Apparatus.

Let Hunt Engineers give you the benefit of their half century experience and accumulated data on coal, ashes and bulk materials handling, to assist in "Keeping the Plant Fit for Profits."

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West New Brighton, New York City

Phillips, Lang & Co., Inc.
431 South Dearborn Street, Chicago, Ill.

New York Office—Whitehall Building

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141 Milk Street, Boston 9, Mass.

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Fighting Friction in the Modern Power Plant

(*Continued from page 27*)

parts should be properly lubricated with a carefully prepared oil suitable for the service intended. As a result, the petroleum expert, of necessity, became a mechanical engineer, or vice versa, or else the two put their heads together to study machine design and lubrication requirements collectively, and the matter of developing suitable lubricants to meet these requirements.

The culmination of all this has not only been an extensive advance in the science of oil refining and compounding, but as well, the development of automatic lubricating equipment of many intricate and ingenious types. It was soon found out that the oil can was inadequate to meet the requirements of modern high speeds, bearing pressures and loads. Therefore, the oiler in actuality by necessity has given way to the oiler in name. In fact, the sight of a dirty, greasy individual clambering over a piece of machinery with an oil can in one hand and a piece of waste in the other, is a rarity today. The oil can is all that remains, and it, more often than not, is but an emergency accessory in case some lead from the automatic lubricating system should clog or otherwise become inoperative. Then only, would the engineer deign to use it, but rest assurred, it would probably be used in a very effective manner. Just because conditions have ordained that he shall no longer "swim" in oil is no reason for his having forgotten how to use the old reliable squirt can. In fact, it is these very conditions that have graduated so many power plant operators from "oilers" to engineers. But clean overalls and the ability to make out a log sheet without turning it into an "oil painting" have not harmed any of them. Today our power plant operator is a student; he can, in all probability, discourse very effectively on the science of combustion, etc., and can hold his own with any lubricating engineer when the latter reels off information regarding viscosity, demulsability, and compound, etc. All in all, an admirable situation has developed,—all due to the progress that has been made by lubrication and lubricating equipment over the past few years.

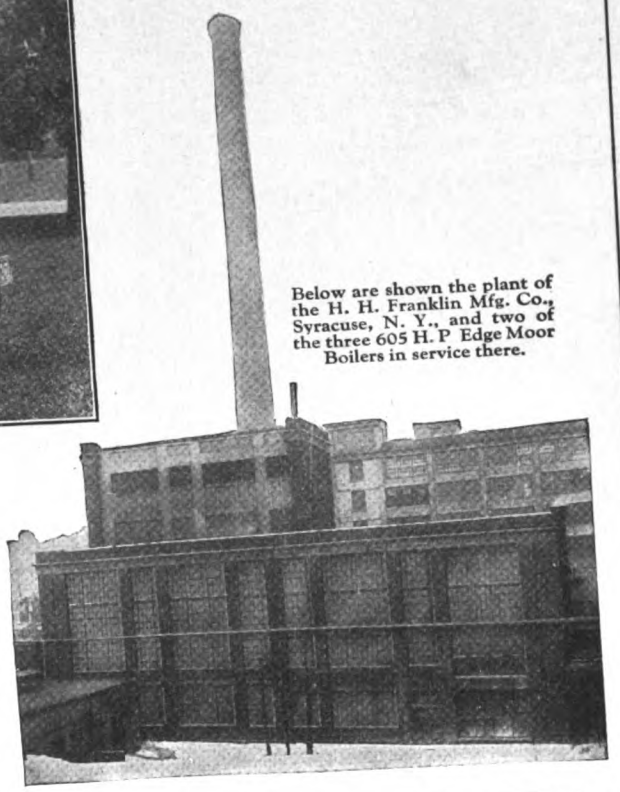
Lubricating equipment has been extensively dealt with in INDUSTRY ILLUSTRATED for March; 1923. In this article we have, therefore, to deal with lubricants. Power plant lubricants can be generally classified under several headings, according to the particular service for which they are intended, *i. e.*,

Steam cylinder lubrication
Turbine lubrication
Engine and Machine Service
Economizers and Stokers
Electrical Equipment
Grease lubrication

Steam cylinder lubrication involves probably more variables than any other class of lubrication. The nature of the steam, the type of engine, the design of lubricating equipment, the arrangement of steam piping, and load conditions all must be given due consideration. Steam cylinder lubrication differs from external lubrication in that the lubricant is not directly



The FRANKLIN



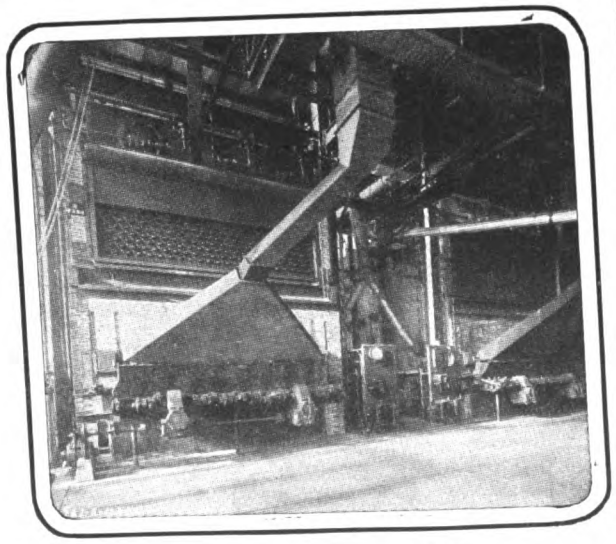
Below are shown the plant of the H. H. Franklin Mfg. Co., Syracuse, N. Y., and two of the three 605 H. P Edge Moor Boilers in service there.

THE qualities that have won unusual success for the Franklin car—economy of operation and maintenance—are no less important attributes of a steam boiler.

These same essential qualities have made possible the outstanding records of the Edge Moor Water Tube Boiler in a score of leading industries.

Franklin standards of manufacturing demand the most efficient equipment for the big plant at Syracuse. Power used there is generated by three Edge Moor Boilers of 605 H.P. each.

Reasons for the exceptional dependability and economy of the Edge Moor Water Tube Boiler are fully described in Catalogue 63. A copy will be promptly forwarded at your request.



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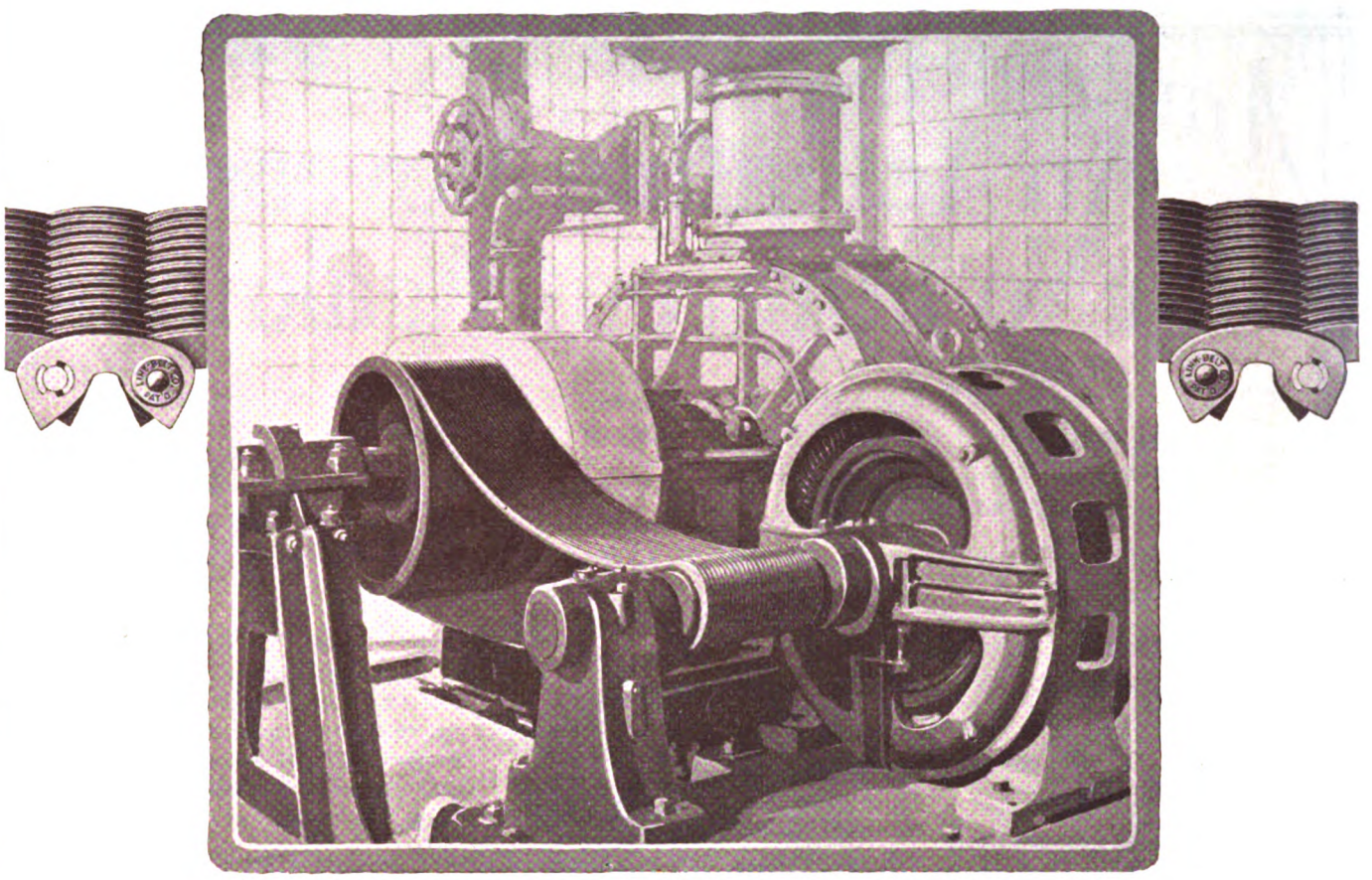
he wearing surfaces, is delivered into the at some point adja- a few feet above, the lve. Thus the steam he transmitting me- he oil. However, in nsure the formation uate film of lubricant per lubrication of the rfaces, the oil must d or divided into min- es, else it will not oints of the valve seat er walls. In general, es as the atomizing as e carrying agent, the delivered to it at tely the point of high- y via a perforated or oon-shaped extension which is screwed into t right angles.

been definitely proven physical condition of will affect the atomi- the oil. For example, w viscosity, containing amount of compound, readily atomized than viscosity-pure mineral so, wet steam will in- e atomization of the oil. o been proven that high ures and velocities in n lead to more complete ion of the oil, although locity will require the lower viscosity oil, while mperature, due to its to promote evapora- the cylinder walls will the use of an oil of lower y, or else the rate of lub- will have to be in- to a certain extent. Due act that steam tempera- ncrease with pressures, nt of superheat (if any), as these other factors, considered.

neral it may be assumed e viscosity of a cylinder be such that the latter able to stand up under and valve pressures at mperature of operation; ne extent of compound e governed by the extent sture in the steam. As a is possible to obtain cyl- oils capable of meeting onditions as the character steam may require.

type and construction of gine will require quite as consideration in the selec- a suitable steam cylinder the nature of the steam. items as whether the cyl- s are located horizontally rtically, the valve design, peed of operation, and the ness of the piston rings will enter into the problem. Corliss engine valves are generally regarded as the more difficult to lubricate, due to the fact that the steam pressure holds them relatively tightly upon the seats. Vertical engines, and those equipped with tail-rods will involve relatively little weight of the moving parts being carried by the cylinder walls and valve seat, hence there will not be the same tendency towards scraping or washing off of the oil film. The rate of delivery of the lubricant can, therefore, be decreased, or, as is often customary in marine service, where using saturated steam, the oil may be done away with and the moisture in the steam relied upon to develop a "water polish" on the cylinder walls, and serve as a lubricant. In stationary practice, as a rule, the lubrication of a vertical engine will involve the same factors as that of a horizontal engine, similar lubricating equipment can be employed, and, therefore, the selection of the lubricant carried out in much the same manner.

In certain power plants boiler





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compound will often be used. This fact must normally be considered when making the selection of a cylinder oil, due to the possibilities of foaming and priming occurring. As a result of this, excess amounts of water which might enter the engines would contain considerable percentages of boiler scale, silica and lime, etc. Substances of this nature have a tendency to saponify cylinder oils which have been compounded with animal fats, with the result that the oil film may be washed off the cylinder walls, etc., in a short space of time.

The lubrication of steam turbines is perhaps the most important phase of power plant lubrication with which the engineer will normally have to deal. High speeds, the probability of considerable heat reaching the bearings, the possibility of steam leaks and water in the oiling system, and frequently inefficient oil purification equipment, all impose severe duty upon the lubricant. Therefore, the utmost care must be observed in choosing it. There are two essential characteristics which must be considered when selecting a steam turbine lubricant, *i. e.*, viscosity and demulsability; though, of course, as well the oil should be a pure, filtered, highly refined product, non-acid in reaction, with a low affinity for water and free from animal or vegetable compounds. Water is the chief element of objection in a turbine oil, and has the most effect upon its serviceability. As a result, the greatest care should be taken to prevent it from entering the oiling system, storage tank, or purifiers.

There are three general means for lubricating steam turbines, *i. e.* (a)—Ring and chain oilers. (b)—Gravity circulating systems, and (c)—Force feed circulating systems.

The first are generally found in smaller machines of about 300 horsepower or less. In such systems the bottom bearings are built with oil reservoirs, and rings or chains are suspended from the shaft. By filling these reservoirs with oil to a certain level, the rings or chains will carry a continuous feed of oil to the shaft when it rotates. This oil is distributed lengthwise along the shaft via suitable oil grooves cut in the top bearing or cap. As long as ring oilers are maintained in proper adjustment and free from vibration, operation will be satisfactory. It is important to keep ring surfaces smooth and free from sharp or jagged edges, otherwise their action may be impaired.

In a ring or chain oiling system the size of the oil reservoir is of importance, due to the fact that frictional heat must be removed. As a rule, this heat will be partly absorbed by the oil in the reservoir and partly radiated to the air; though in certain installations cooling coils may be installed. At all events, the oil reservoir should be large enough to allow sufficient time for the oil to remain at rest in order to insure against excessive heating, and to enable the precipitation of sludge, etc.

Gravity and force feed circulation systems are customarily installed on turbines of larger size. The volume of oil in service is considerably greater than in ring oilers. Due to the fact that such systems are usually installed in conjunction with oil purifiers of some sort, the possibility of overheating or contamination is materially reduced. In general, gravity cir-

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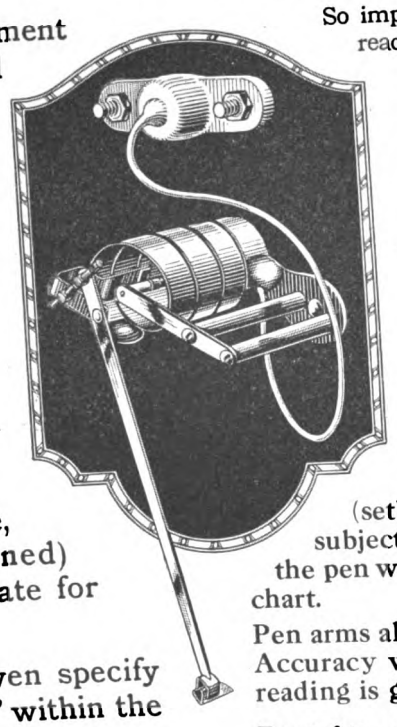
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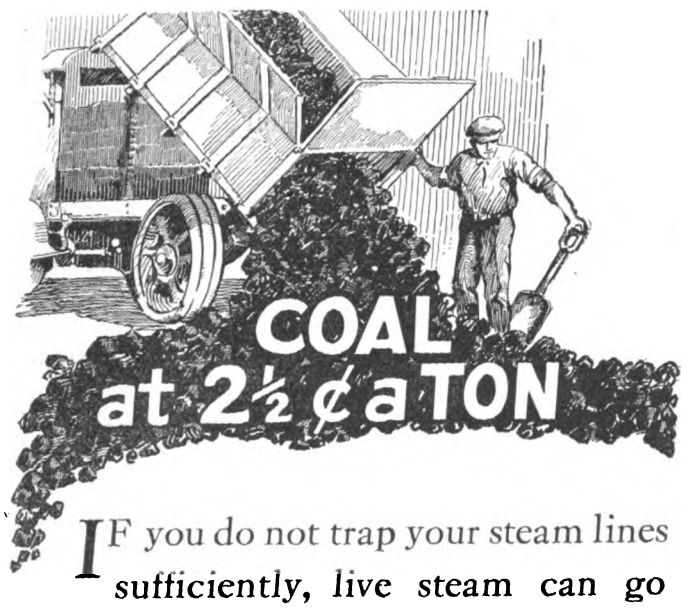
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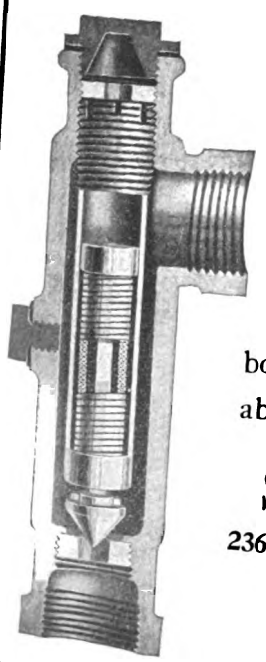


IF you do not trap your steam lines sufficiently, live steam can go straight to the sewer—and with it goes the cost of the coal burned to produce the steam. Just one untrapped ¾" steam pipe would waste more than a ton of coal every 52 hours.

You can positively prevent that waste at a cost of $9.45 list, for a

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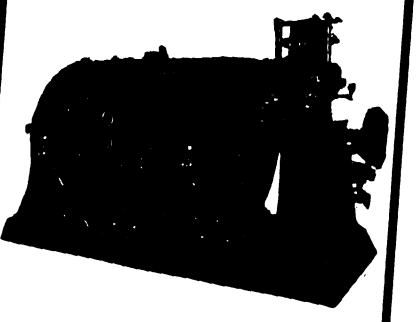
culating systems are larger and more bulky than force feed, due to the greater storage capacity that is required. This is of advantage in that a large amount of oil can be fed instantly to any bearing in event of indication of overheating, thus maintaining the proper temperature by sheer volume of oil.

Engine and machine lubrication is a term often applied to the external lubrication of reciprocating engines, pumps, compressors, and miscellaneous auxiliary machinery in the power plant. There are numerous parts on such equipment such as guides, pins, crossheads and rocker arm bearings, where the lubricant must be applied externally, either by means of oil cans, oil cups, force feed lubricators, splash oiling systems, or grease cups,—hence the term external lubrication. Oils for this purpose are known as engine and machine oils. They should be selected both according to the operating conditions they are intended to meet, and their physical adaptability. In choosing an oil of the proper viscosity for such service, consideration should be given to the size of the bearings, the speed of the machine, the probable quantity of oil necessary to insure efficient lubrication, and the operating temperatures prevalent. In any case the idea should be to obtain an operating viscosity in the oil such that a suitable film of lubricant will be maintained at all times, and to insure against the oil flowing through the bearing too rapidly.

The essential points to observe in selecting an efficient and economical engine and machine lubricant are:

1. The viscosity must be sufficient to prevent metal to metal contact.
2. Tendency towards breaking down, decomposition, gumming or emulsification should be as low as possible.
3. Internal friction in the oil film must be low. This is often regarded as a function of the viscosity.
4. The lubricant should flow readily when required, however low the operating temperature. In a semi-solid lubricant this applies to the oil content.
5. There should be no tendency towards liberation of acids or alkalis which would tend to corrode the bearings.

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of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

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6. No abrasive fillers or thickeners should be used which would tend to wear the bearings abnormally.
7. The oil should separate readily from water, sludge or other foreign matter, should it be destined for usage in a circulating or splash feed system.
8. The vaporization tendency should be as low as possible.
9. The flash point should be so high as to insure safety in operating even under abnormal temperature conditions.

The nature of the oiling system will influence the selection of an engine or machine oil to the extent that there should be a certain relation between the viscosity and the amount of oil fed to the bearing. For example, hand lubricated or cup-oiled bearings, which are usually incapable of being flushed out with oil, must naturally retain their oil over a longer period of time than is necessary in splash or circulating systems, hence a somewhat heavier oil is usually selected for ice.

Where it is possi... tain a steady and ... uniform stream of ... with the bearings a... and circulating syste... tional heat generat... carried off to a cons... tent by the flood of ... lubricating system ... edly essential that ... capable of separat... and rapidly from wa... and foreign matter. ... systems the lubrica... comparatively severe ... ing passed through a... the systems with rel... time for cooling or s... usually without any ... whatever.

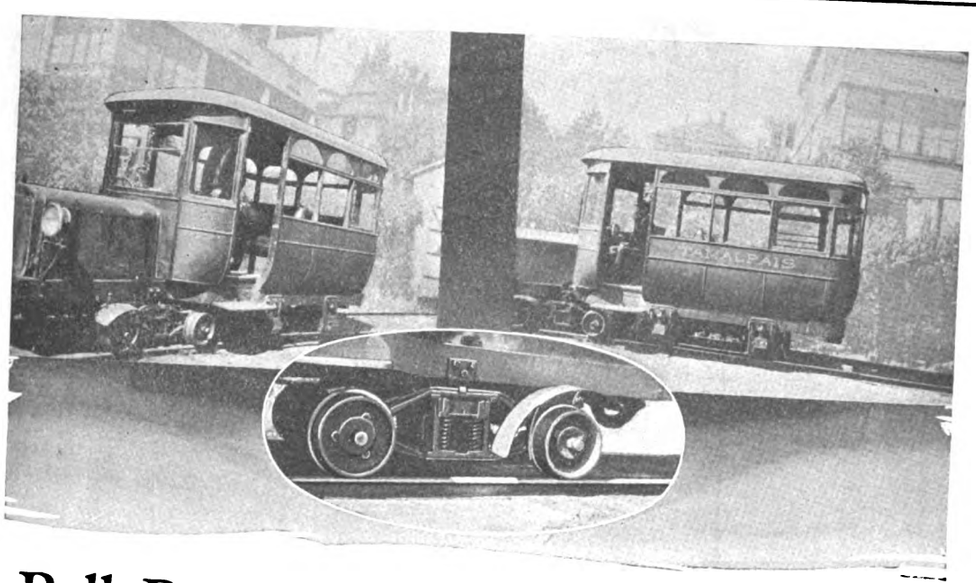
Economizer and ... chanisms involve no ... as a rule in their lubri... the same grades of ... as used elsewhere in ... plant will be suitable ... case of economizers w... mally have to deal ... scraper driving mecha... with the forced draft f... motive power. Scrape... mechanisms will in... motors and such other ... as the reversing devic... chains and miscellane... ings. Motor lubricati... cussed hereafter. On ... equipment it will be nec... essary to insure the ... and proper applicati... good, adhesive gear a... lubricant, selected acc... the type of driving e... stalled, (if any). Such ... cant should never be s... ously applied as to dr... thrown off by centrifuga... in event of abnormal ... the operating temper... Shaft bearings are usu... the split or solid babbitt... equipped either for hand ... or with oil or grease cups.

Forced draft is often... sary in many power pl... which event mechanic... fans are installed. Usual... are driven by small stea... inder, horizontal or ... steam engines, or electr... ors. Engine lubrication ... tical with that of the mai... the features of which ha... mentioned heretofore.

Stoker lubrication is ... economizer lubrication ... volves much the same ... equipment and lubricants ... is also the same problem ... able high surrounding te... tures, hence the lubricat...

(Continued on page ...

SKF



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SUBJECTED to severe side thrusts and making a seven per cent grade on "The Crookedest Railroad in the World," the Hess-Bright deep-groove ball bearings on the front truck of this car running up Mount Tamalpais, California, have been in continuous service since 1916. The original ball bearings are still in service and have never been removed from the truck for any cause.

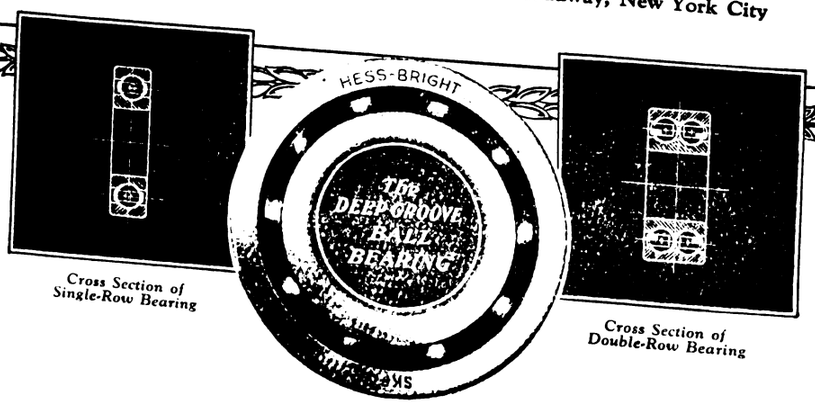
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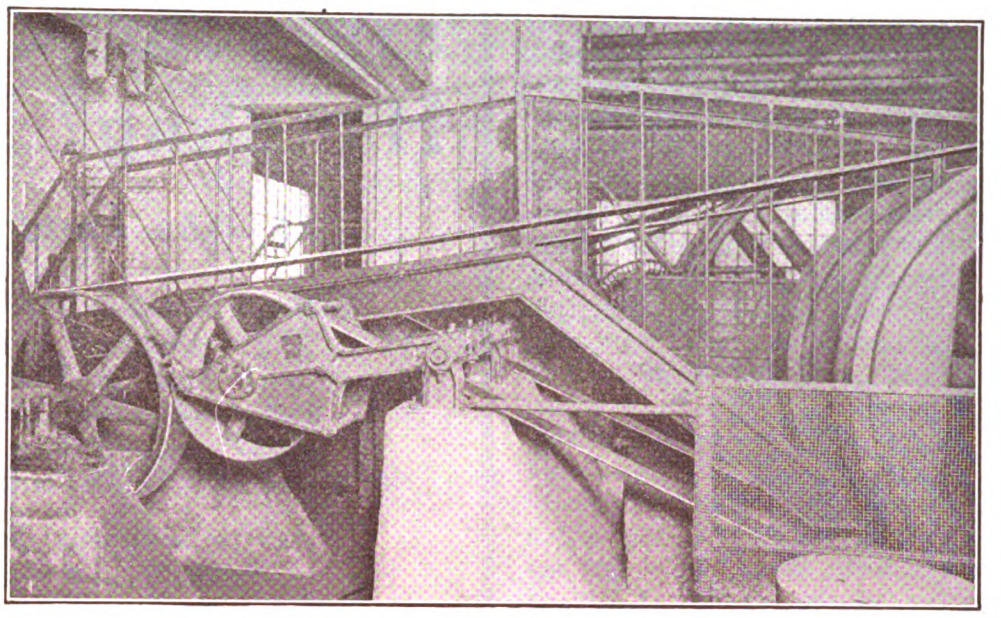


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Cross Section of Double-Row Bearing

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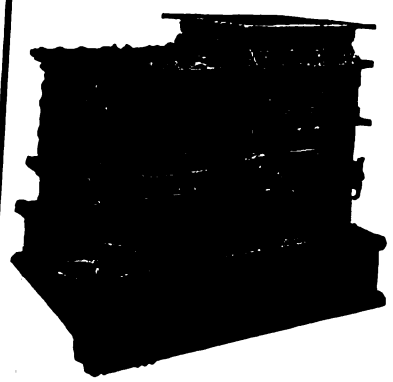
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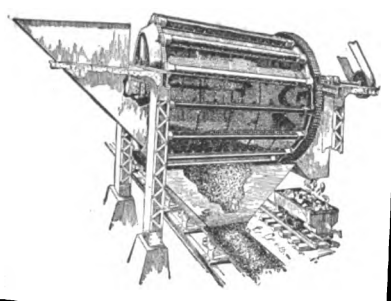


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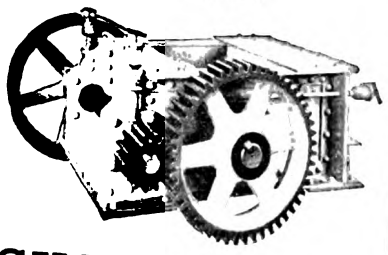
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35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

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(*Continued from page 70*)

be selected with this fact in mind. In general we will have to deal with the lubrication of gears, chains, shafting, and the driving engine or motor. Mechanical stokers can be broadly classified as being driven directly, or by worm or spur gearing. Stokers operate at relatively slow speeds, and for this reason reduction gearing is usually provided to step down from the higher speed motor, turbine, or steam engine. The question of the suitable gear compound must be decided by the type of drive, *i. e.*, with a worm drive, enclosed case system, a relatively liquid, mineral lubricant should be used which will be sufficiently adhesive to stick tenaciously to the teeth, resist the wiping action of the worm, and still be fluid enough to serve as a lubricant for the worm shaft, bearings and thrusts. With an open gear case, however, a comparatively inert lubricant should be used, with the added qualification of not dripping, or tending to be thrown off by centrifugal force.

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How Much Materia are your Conveyor Handling?

Do you know?

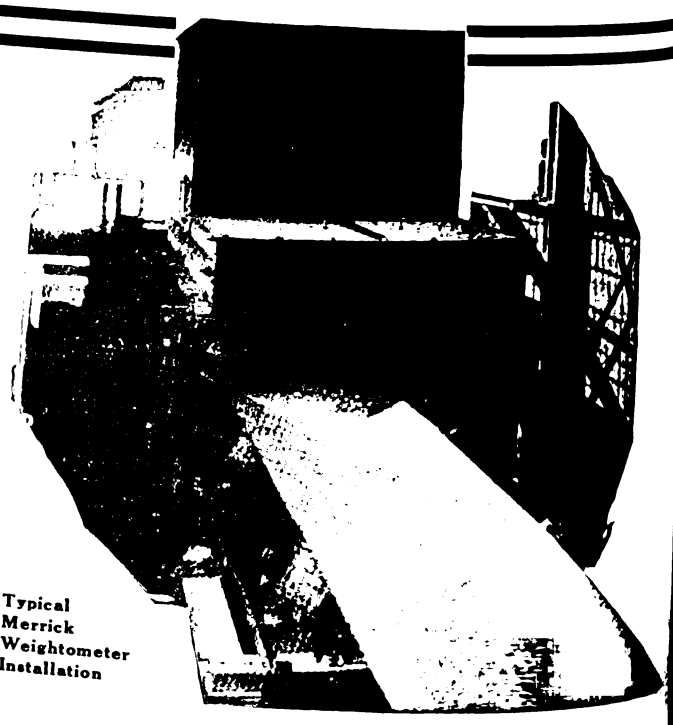
If not, you need a Merrick Weightometer, which weighs all conveyor handled material—coal, sand, coke, stone, gravel, rock, pebbles, wood chips, etc.—while in transit, and enables you to know exactly how much is being or has been transported.

As a precautionary measure enabling you to check the materials or products you buy and sell, the Weightometer is invaluable. It tells you exactly how much you receive, how much you ship, or gives you a check on mill operations.

Easily installed, the Merrick Weightometer requires no operating expense because its action is entirely automatic; no attendant being necessary. Materials are weighed and results recorded as they are carried along on the conveyor without the flow being interrupted or retarded.

Hundreds of concerns no longer rely on bills of lading to ascertain weights. The Merrick Weightometer being guaranteed to 99% accuracy gives them the information they need without delay and without the possibility of mistake.

We'll gladly send "Merrick Circulars" showing types of installations, without obligation. Send for them.

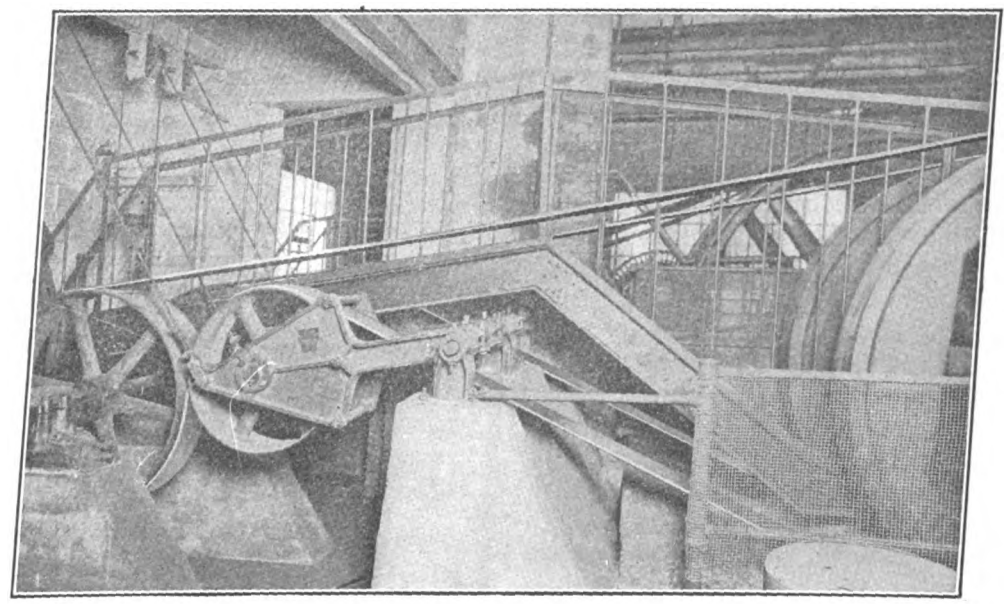


Typical Merrick Weightometer Installation

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Lineshaft turned by 200A Motor also with Lenix.

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Is the *original* short center belt drive.

In the eighteen years that have elapsed since the first Lenix was placed in operation, thousands have been sold. The drives on which they are installed range from 1 to 1400 HP with belts from 2" to 60" wide. Some of the drives have the tight side of the belt on top, some on the bottom; some are horizontal drives, some vertical and others quarter-turn.

The Lenix is not an "idler." It is a "belt wrapper," scientifically applied to belt drives for the purpose of eliminating belt slippage and increasing the capacity of the drive.

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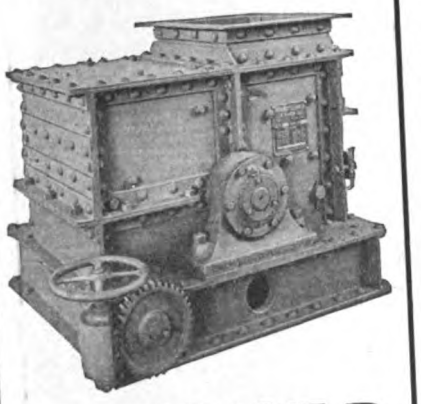
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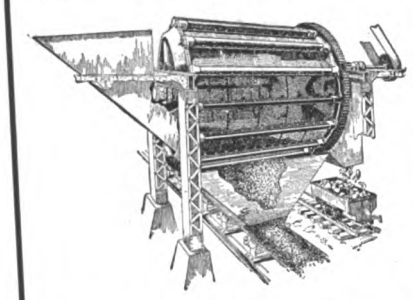


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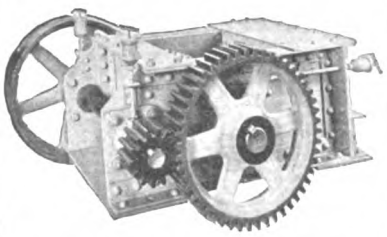
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(*Continued from page 70*)

be selected with this fact in mind. In general we will have to deal with the lubrication of gears, chains, shafting, and the driving engine or motor. Mechanical stokers can be broadly classified as being driven directly, or by worm or spur gearing. Stokers operate at relatively slow speeds, and for this reason reduction gearing is usually provided to step down from the higher speed motor, turbine, or steam engine. The question of the suitable gear compound must be decided by the type of drive, *i. e.*, with a worm drive, enclosed case system, a relatively liquid, mineral lubricant should be used which will be sufficiently adhesive to stick tenaciously to the teeth, resist the wiping action of the worm, and still be fluid enough to serve as a lubricant for the worm shaft, bearings and thrusts. With an open gear case, however, a comparatively inert lubricant should be used, with the added qualification of not dripping, or tending to be thrown off by centrifugal force.

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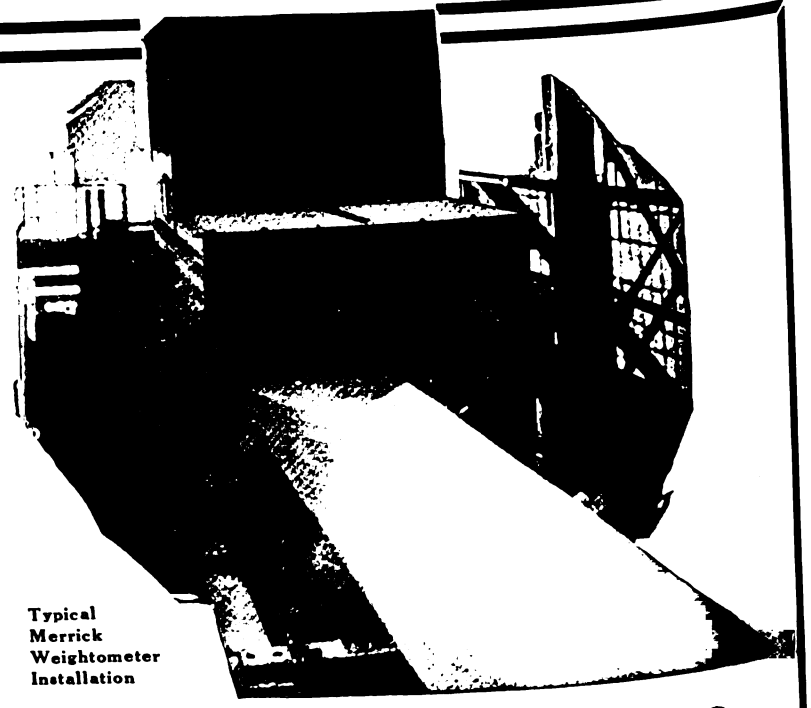
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Hundreds of concerns no longer rely on bills of lading to ascertain weights. The Merrick Weightometer being guaranteed to 99% accuracy gives them the information they need without delay and without the possibility of mistake.

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Typical Merrick Weightometer Installation

MERRICK SCALE MFG. CO.

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Systems and Application of Pneumatic Conveying

(*Continued from page 25*)

4. The distance over which the material is to be conveyed.
5. The difference in level between the point at which the material is fed into the system and the point where it is delivered.
6. The method and regularity of feeding the material into the system.
7. The method to be adopted for separating the materials from the conveying air at the desired point of delivery.

After consideration has been given to the above points, pneumatic conveying systems naturally fall into two main classes, the pressure or blowing system, and the vacuum or suction system. There is a very important difference between plants in which the materials pass through fans or blowers, and those in which the conveying is carried out entirely under suction. In recent years, the vacuum system, including most of the examples cited here, has taken the lead. The two main classifications mentioned above have three sub-divisions, each depending on the pressure under which the system operates. The complete classification is:

Vacuum systems—low, medium, and high.

Pressure systems—low, medium, and high.

The low pressure or the low vacuum systems are, with few exceptions, used in dust collecting work, and are mentioned here merely to make the outline complete. These systems are used, in certain cases, for conveying sawdust, shavings, wool, feathers, and similar light materials, and operate with the pressure or vacuum of 6″ to 10″ of water. A comparatively large air volume is required, ranging from 30 to 70 cu. feet of air per pound of material handled, depending on the nature and weight of the materials, and the distances over which they must be conveyed. Fans are generally used for this work.

The medium pressure and medium vacuum systems have been used extensively for many years, especially for handling grain and similar materials. Rotary blowers or vacuum pumps supply the energy, and 4″ to 10″ of mercury is the pressure or vacuum used. In general design these systems resemble the high pressure and high vacuum systems. However, as they use a large volume of air, they also use larger pipe lines, and collecting stations, than do the high pressure systems. From 3 to 10 cu. feet of air per pound of material handled is the amount required, depending on the nature and density of the materials handled, and the distance the material is moved. They will handle, however, the same materials as the high systems, subject to certain disadvantages, which will be pointed out later.

Insofar as the equipment is concerned, the high pressure system is the simplest of all. It consists of a high pressure blower, a pipe line, and collector. The material can be fed into the pipe line either through a specially designed feeder or through an ejector. When materials containing little or no dust,

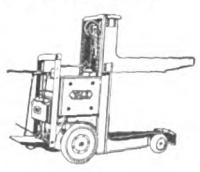
YALE—the key to lower handling costs
Chapter 4 on Storage Battery Trucking



K-20 Edison $1825. Exide $1575.



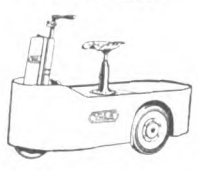
K-22 Edison $2350. Exide $2100.



K-23 Edison $1825. Exide $1575.



K-24 Edison $1925. Exide $1675.



All prices F.O.B. Works with Edison or Exide Batteries

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The "K" model Yale Industrial Trucks are so designed and built as to permit of such definite manufacturing and operating economies that a *new standard of values* has been established for this type of vehicle.

A concrete example will best illustrate this fact.

The Yale Spur-Geared Power Axle is one of the major units interchangeable between all of the trucks in the new "K" series. This means that "K" trucks are so built that the Power Axle can be taken out of one type and put into any of the others in this series.

This means that the cost of manufacturing and assembling Yale Power Axles is greatly reduced since only one type is made for all "K" trucks. This same idea of interchangeability of parts has been applied throughout the entire series with the result that the lowest possible prices have been attained for these Yale quality products.

This automotive method of manufacturing and assembling so simplifies the building of Yale "K" model Industrial Trucks that their cost is reduced to a minimum, without in any way lowering Yale standards of mechanical excellence.

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such as grain, wheat, wood chips, whole pepper or the like are to be handled, the materials can simply be blown through the pipe line into a cyclone, or directly into a bin or warehouse. This is illustrated on the right side of figure 6.

Where, however, dusty materials such as soda ash, plaster of Paris, cement, etc., are conveyed, the equipment must include in addition an air filter to prevent the dust from being carried away with the escaping air, thus eliminating waste and nuisance. This is illustrated on the left side of figure 6. The use of this pressure system is in practice generally limited to where the materials to be conveyed can be fed into fixed receivers at stationary points, therefore the rapidly increasing use of pneumatic conveying in late years has been mainly of the high vacuum type. When this system is employed, a flexible feeding hose is used, and pipe lines can be run from the same collecting station to various points, permitting greater flexibility and hence adaptability. A composite and diagrammatic layout of this system is shown in figure 7.

During the years 1916 to 1918 it became extremely difficult to get materials for sacks. For this reason such products as cement, soda ash, gypsum, lime, etc., very often had to be shipped in bulk in box cars. This practice has now developed from an emergency measure to a common method of shipment, because of the economies which it effects. Shipping in this manner, however, presents a very difficult unloading problem, but the need for an economical unloading device was met, and pneumatic conveying systems are now being successfully employed on these operations.

When mentioning the subject of car unloading, we touch immediately on the essential difference in the adaptability of the medium vacuum system in comparison with the high vacuum system. With the medium vacuum system, an air volume of from 3 to 10 cu. feet per pound of material is required, with a vacuum of 4 to 10″ H.G. This necessitates (to show a concrete illustration) using a 10″ pipe and suction hose, for unloading 20 tons per hour from a car, conveying material a distance of, say, 150 feet, using an air volume of 4,000 cu. ft. per minute, and with a vacuum of 8 to 10″ H.G.; while under the same conditions and with the same capacity and distance, the high vacuum system would require only 1600 cu. feet of air per minute, at 16 to 17″ H.G. vacuum, and only a 4″ conveying pipe and hose.

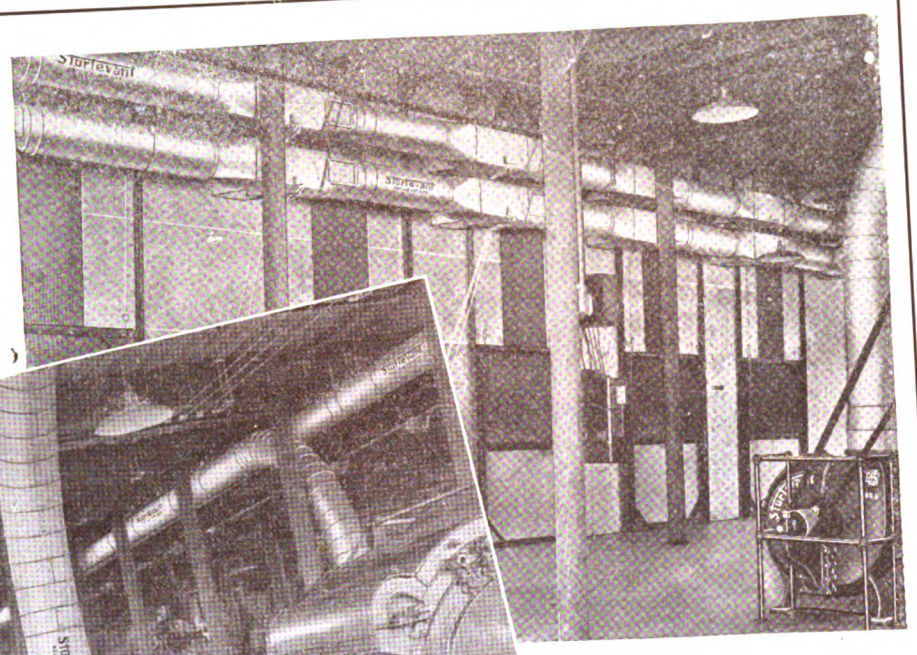
It will be very easy for everyone to understand the difference between handling a 10″ heavy suction hose in a car and a 4″ hose, the difference being that the first is nearly impossible, and the other is thoroughly practicable.

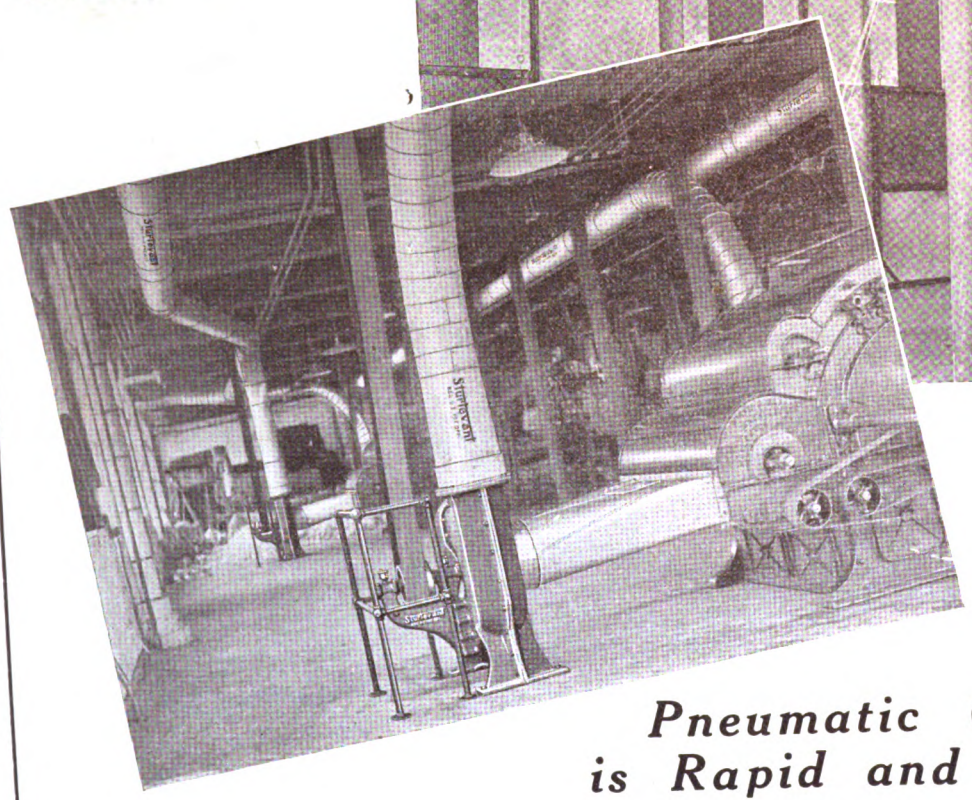
What applies to hose also applies, of course, to pipe lines and size of dust collecting stations and dust collectors.

It is apparent that a small pipe line is easier to erect almost anywhere than a large cumbersome line.

The high velocity and vacuum used have made it feasible to convey the heaviest known materials as well as the lightest, and systems of this type are actually handling such materials as metallic lead from atomizers, which weigh from 450 to 500 pounds per cu. foot, and such materials as talcum powder, car-

Showing the delivery end of two Mixing Pickers. Sturtevant Fans and conveyor systems are used to convey the wool to the bins.





Bins for Storing Wool and showing Switching Arrangements possible with Sturtevant conveyor systems. Wool in this case can be diverted into any bin desired.

Pneumatic Conveying is Rapid and Economical

Sturtevant Pneumatic Conveying Systems are largely used on materials, such as:

Wool, cotton, hair, flax, hemp, jute, rags, shoddy, chips, cork dust, shavings, waste paper, pulverized fuel, jute bagging, grain seeds, coffee, cereal, wood or paper pulp, tan bark, etc.

Sturtevant Dust Collecting Systems are also made to meet the needs of many industries in coping with the hazards and unnecessary costs of accumulating dust, waste and refuse.

The Sturtevant Pneumatic System of conveying materials is one that is extremely rapid and economical, avoiding much labor in handling material, eliminating hand trucks, occupying no valuable floor space, and protecting the product while in transit.

In textile mills, for instance, systems have been installed where the wool is never touched by hand from the time it is fed to the picker until it reaches the carding machines—apply this same principle to your product and you can readily visualize a greatly reduced payroll and less capital tied up in seemingly necessary vehicular handling equipment.

As a matter of fact, pneumatic conveying systems can be used with financial benefit in many industries to take the place of the now expensive day laborer.

Our engineers will gladly look over your plant without placing you under any obligation whatsoever. Why not write to have them call this month?

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bon black and powdered coal.

It will be noted from the various layouts that at the base of the receiver there is a rotary discharge lock which dumps the material into the storage bin (a general view of this lock is shown in figure 8). The rotary lock greatly hampered the development of pneumatic conveying systems. It was necessary for this rotary lock to be tight, so as to maintain the vacuum or pressure in the conveying line, but due to the wear on the surface of the rotating drums, there was more or less leakage, thus reducing the efficiency of the system.

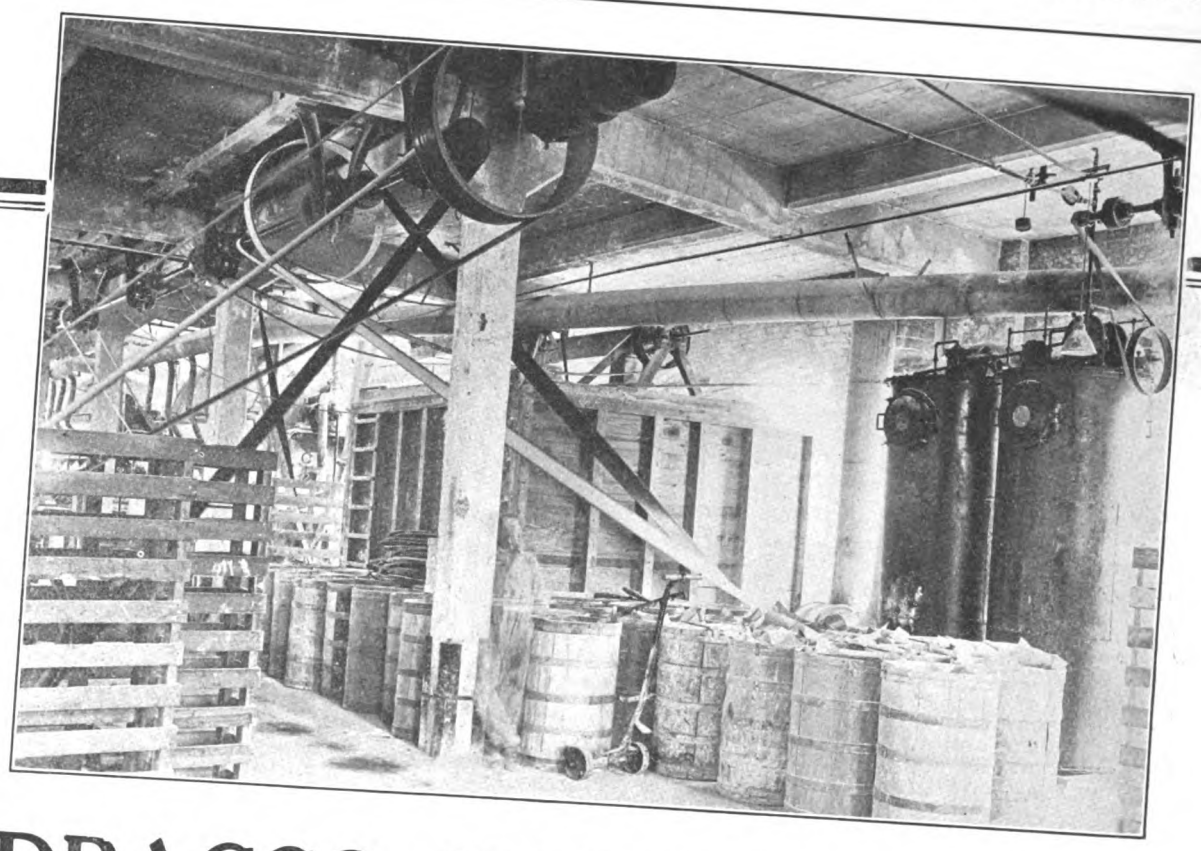
Another difficulty was the choking of these locks by large pieces of materials becoming wedged between the drum compartments and the casing. In order to overcome this deficiency, a multiple stage air lock has been designed, operating on an entirely different principle, permitting the large pieces to pass through, and because one of the stages of the lock is always closed, there is absolutely no leakage of air while the other two are discharging. The regulation of this lock is entirely automatic and self contained, and a general exterior view is shown in figure 9. The development of this lock is now making it possible for pneumatic conveying systems to handle materials that a few years ago presented serious problems, due to their effect on choking or injuring the more common rotary type dischargers.

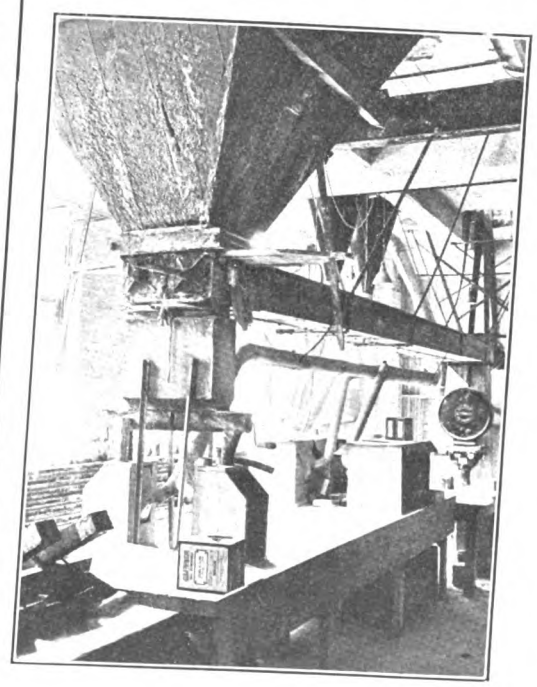
There has also been great improvement in the filters which clean the air of all dust particles before it reaches the fan or blowers. A complete installation of vacuum pump filter and simple rotary air lock of American manufacture is shown in figure 10. Note the compactness of the equipment, and the small space that it occupies.

Figure 11 is not presented as a comparative example of British equipment, but is used to illustrate the difference between American and British design. It shows the vertical vacuum pump, filter and air receiver, but the equipment is not an actual installation. The picture was taken in the shop before shipment. To obtain a clear view of the diagrammatic layout of British manufacture, we will look at figure 12, which shows the arrangement of a combined coal and ash plant at the works of Messrs. Wardell & Davenport, Leeds. In this plant the coal is discharged into an underground bunker, and elevated from same into the overhead bunkers above the boilers. When the plant handles ashes from the ash tunnel, the underground bunker is emptied of coal and the ashes put into the same. After the clinkers are broken to a suitable size, passing through the grid, they are passed through the same discharger as the coal, and gravitate down the chute to the ash cart below.

In this case, the manufacturers found that the ordinary form of discharge valve such as was used for coal and grain, could not be used for ashes, owing to the abrasive nature of the material, and it was therefore necessary for them to design an automatic discharge valve which had no wearing surfaces. This has proved so satisfactory that they are now using it for all classes of materials, and have eliminated the common rotary valve formerly used.

This valve of British manufacture is an improvement and





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shows that foreign countries are also investigating the more extensive use of pneumatic conveying and developing new air locks along entirely different lines from that shown in figure 9. In this same figure, an interesting point to note is the vertical vacuum pump, of which very few are in service in this country.

Considering that pneumatic conveying is now becoming of international importance, it is a subject that deserves a great deal of study and attention, and the following installation diagrams and photographs, both of American and British manufacture, will show some of the successful installations which are now in operation.

Figure 13 shows the plan and elevation or general arrangement of the coal handling plant at the works of the India Rubber & Gutta Percha Co., Ltd., at Silvertown, England. In this plant, coal is taken from barge A and discharged into the main storage bunkers at points B and C. It is also taken from the main storage bunker and discharged to a belt conveyor which distributes the coal to the bunkers over the boilers. Alternatively, the same plant is arranged to take coal from railway trucks at point D and discharge it at point E to the belt conveyor for distribution.

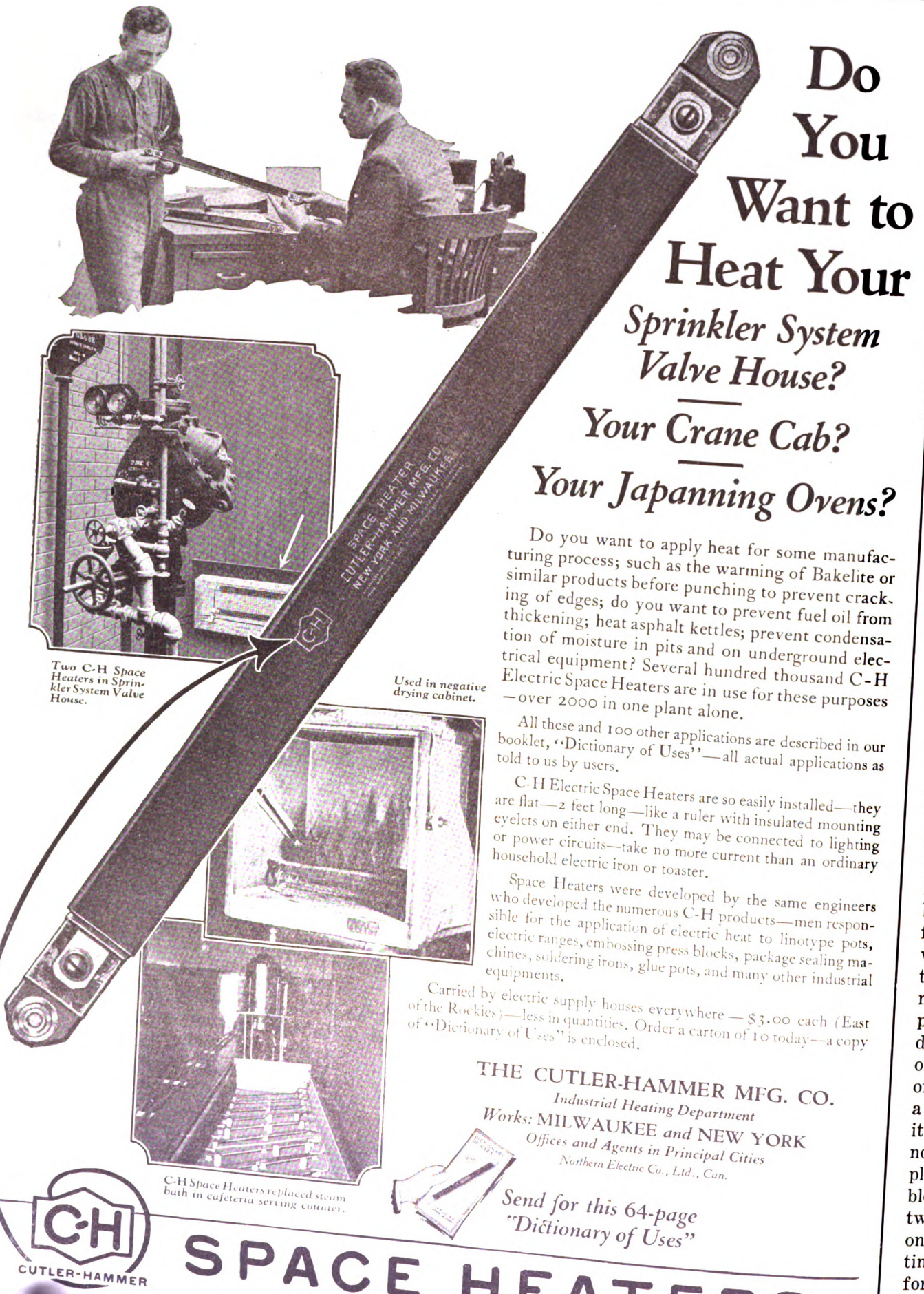
The vacuum pumps, ejectors, etc., are arranged in position F. The capacity of the dischargers B and C is 30 tons per hour, and discharger D about 15 tons per hour.

It will be noted that the coal is conveyed for a considerable distance, and the air has to be handled for a considerable distance when material is to be lifted from point E to point F.

Figure 14 shows an interesting installation operating in a fertilizing plant. To the left is shown the warehouse in which crushed dry bone and bone meal are stored. The pneumatic conveying collecting station and pump are placed on the bone grinding plant. A suction pipe line, with flexible hose, sucks the material from the warehouse at the rate of 30 tons per hour, and discharges it to screens or grinders. A second pipe line comes down from the grinder building and leads into a dryer room, and this pipe line is used in carrying the dry bone meal from dryers to the grinding plant. When this installation was first installed, it reduced the labor costs by the wages of 20 men.

While considerable progress has been made, and possibly more compact equipment has been developed in this country, there are more extensive installations of pneumatic conveying equipment in England than in America. One very elaborate installation is shown in figure 15, of a combined suction and blowing system for handling dry brewers' grains which are used as cattle feed. In this plant a reciprocating pump may be used as an air compressor or vacuum pump. The dry grain is elevated by means of bucket elevators to the top of the bunker, and gravitates to a screw conveyor, which feeds it to the pneumatic conveyor nozzle, connected to the blower plant. From this point it is blown to the various floors of two buildings, and stored there on the floors. In the winter time, when there is a demand for this cattle feed, the action of the plant is reversed, and suction nozzles are fitted on the pipe lines where required.

(Continued on page 78



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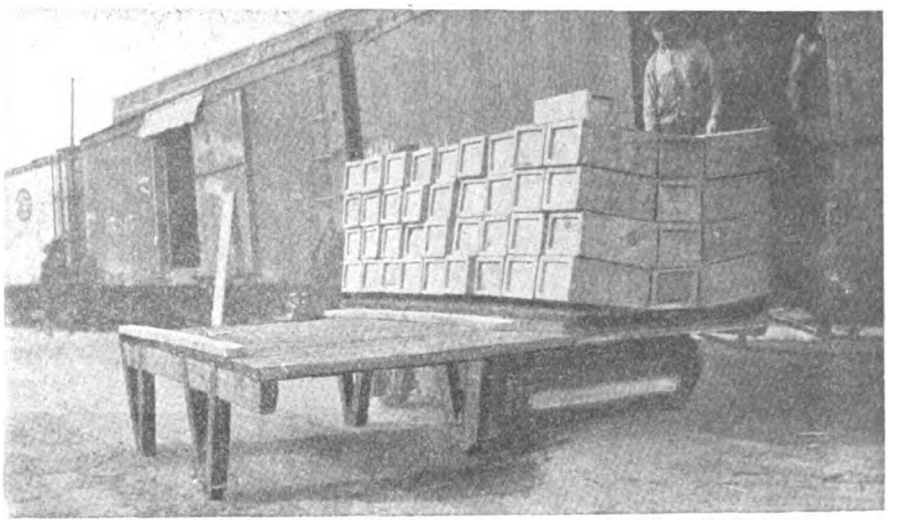
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shows that foreign countries are also investigating the more extensive use of pneumatic conveying and developing new air locks along entirely different lines from that shown in figure 9. In this same figure, an interesting point to note is the vertical vacuum pump, of which very few are in service in this country.

Considering that pneumatic conveying is now becoming of international importance, it is a subject that deserves a great deal of study and attention, and the following installation diagrams and photographs, both of American and British manufacture, will show some of the successful installations which are now in operation.

Figure 13 shows the plan and elevation or general arrangement of the coal handling plant at the works of the India Rubber & Gutta Percha Co., Ltd., at Silvertown, England. In this plant, coal is taken from barge A and discharged into the main storage bunkers at points B and C. It is also taken from the main storage bunker and discharged to a belt conveyor at D, which distributes the coal to the bunkers over the boilers. Alternatively, the same plant is arranged to take coal from the railway trucks at point E and discharge it at point D to the belt conveyor for distribution.

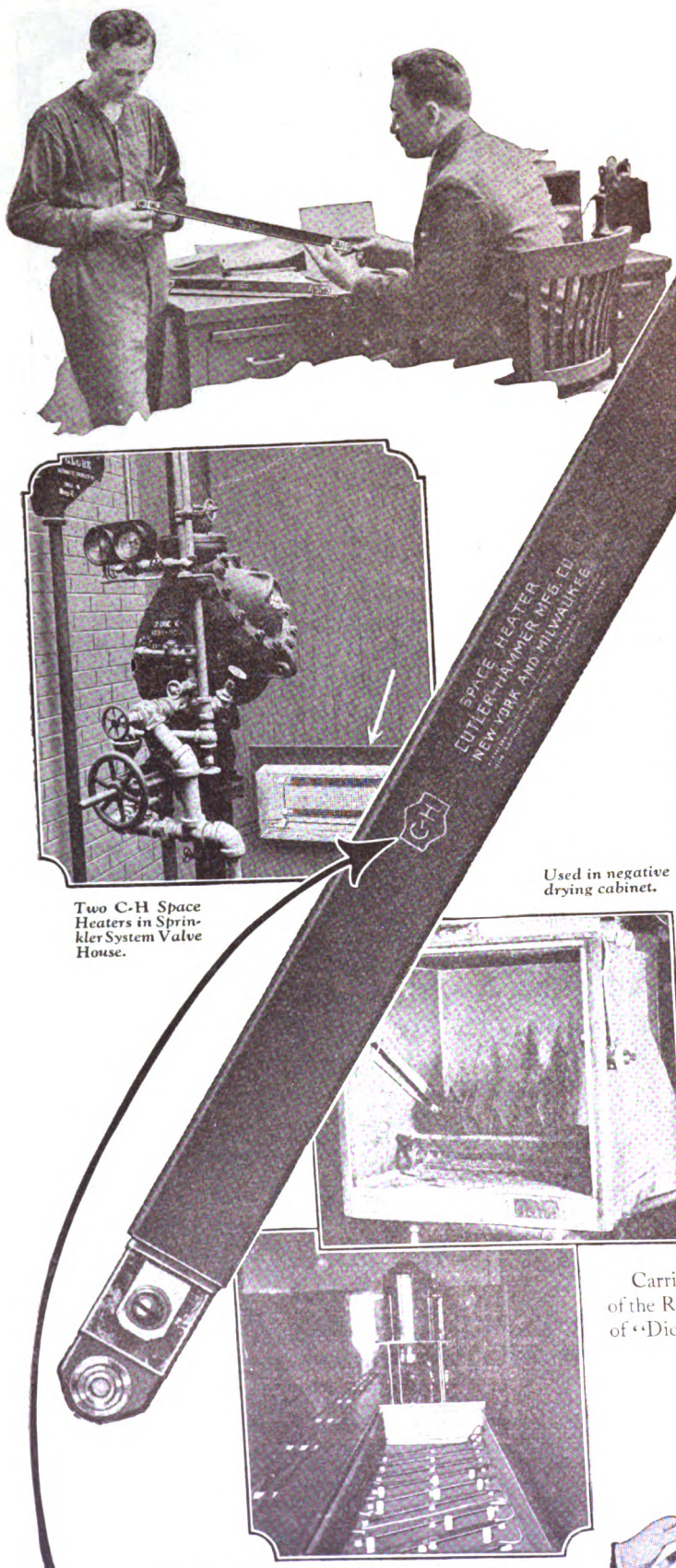
The vacuum pumps, dust collectors, etc., are arranged in position F. The capacity of the dischargers B and C is 20 tons per hour, and discharger D about 15 tons per hour.

It will be noted that the coal is conveyed for a considerable distance, and the air is also handled for a considerable distance when material is being lifted from point E to point D.

Figure 14 shows an American installation operating in a fertilizing plant. To the left is shown the warehouse, where crushed dry bone and bone dust are stored. The pneumatic conveying collecting station and pump are placed on top of the bone grinding plant, and the pipe line, with flexible hose, sucks the material from the warehouse at the rate of 20 tons per hour, and discharges either to screens or grinders. A second pipe line comes down inside the grinder building and passes into a dryer room, and this pipe line is used in carrying dry tankage from dryers to the grinding plant. When this installation was first installed, it reduced the labor costs by the wages of 20 men.

While considerable progress has been made, and possibly more compact equipment has been developed in this country, there are more extensive installations of pneumatic conveying equipment in England than here. One very elaborate installation is shown in figure 15, of a combined suction and blowing plant, for handling dry brewers' grains which are used as cattle feed. In this plant a reciprocating pump may be used as an air compressor or vacuum pump. The dry grain is elevated by means of bucket elevators to the top of the bunker, and gravitates to a screw conveyor, which feeds it to the pneumatic conveying nozzle, connected to the blowing plant. From this point it is blown to the various floors of two buildings, and stored loose on the floors. In the winter time, when there is a demand for this cattle feed, the action of the plant is reversed, and suction nozzles are fitted on the pipe lines where required, and

(Continued on page 78)



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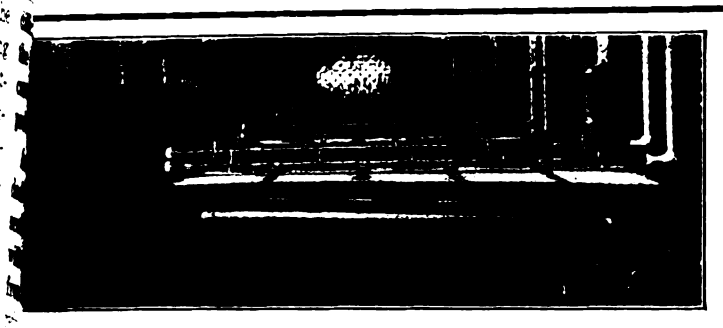
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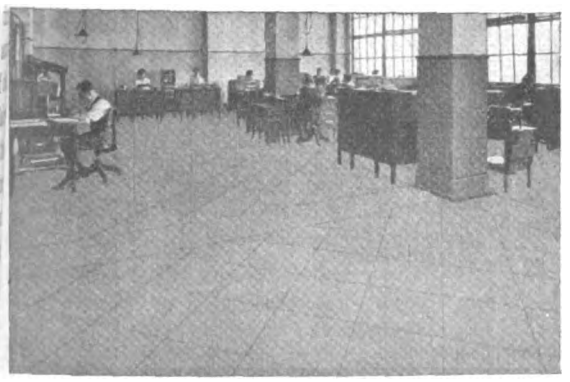
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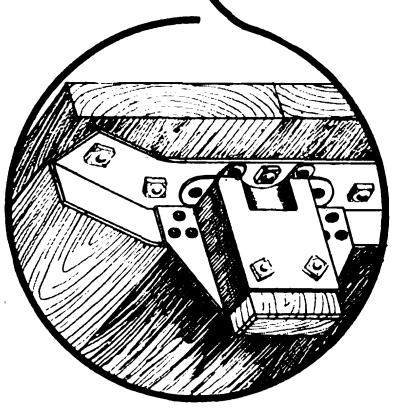
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STEEL LIFT TRUCK PLATFORMS





Hydraulically driven rivets, instead of bolts, hold the steel leg supports to the runners.

Riveted Hydraulically Not Bolted

Don't overlook this when comparing platform values.

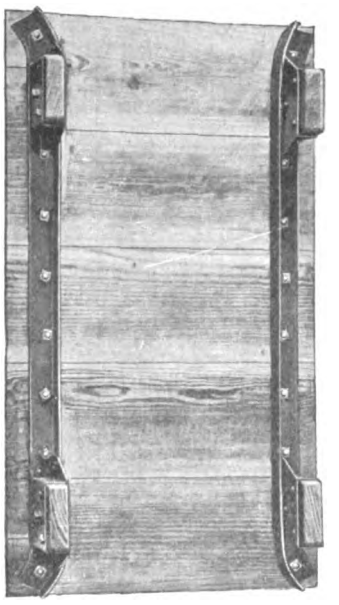
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(*Continued from page 76*)

grain is then drawn to a cyclone discharger, and discharged through automatic weighers into bag chutes. The capacity of this plant when either blowing or sucking, is from 8 to 10 tons per hour.

Another interesting American installation is shown in figures 16, 17 and 18, where a pneumatic conveying installation is being used to handle from 5 to 10 tons of arsenic per hour, according to the distance from the pump and collecting station to the settling chamber, which is being unloaded. Figure 16 shows the inside of the settling chamber, and the white material is arsenic. The conveying nozzle and flexible hose is attached to the pipe line shown in figure 17, which runs over the various doors of the settling chambers. The hose can be attached to any of the Y connections. A complete layout, showing pipe lines, dust collectors, and screw conveyor for carrying the arsenic from the discharge lock to the refining furnace is shown in figure 18. Arsenic handling has always presented a difficult conveying problem, but the installation of pneumatic conveyors has eliminated the problem entirely.

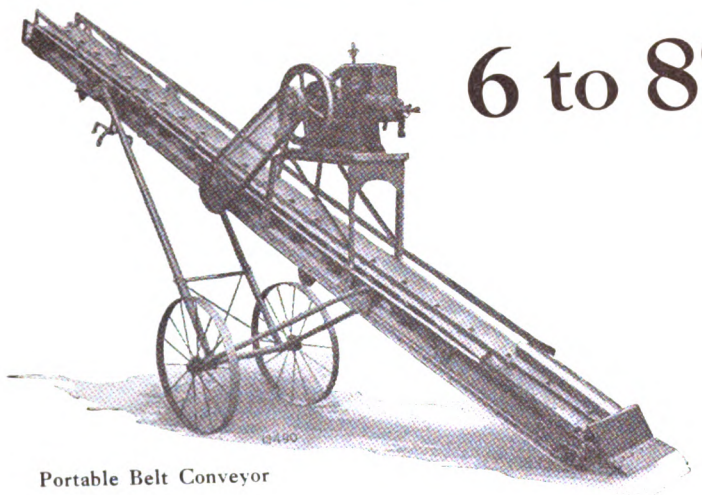
An instance where a great deal of waste, trouble, etc., presented itself was in connection with the removal of "blue fume" from flue systems in large lead refineries. This fume, as illustrations 19 and 20 indicate, had to be removed from a number of collecting hoppers, collectors, etc., scattered unsystematically all over the place. In the past, the operation consisted of tapping it to the ground, shoveling it into wheelbarrows, loading it into box cars, and then shipping it to other plants for re-treating. This was a very wasteful process, and nearly impossible on windy days. To collect this material with any type of mechanical conveyor, such as screw conveyor, belt, etc., was given up as hopeless, but a pneumatic conveying system permitted the placing of storage bins close to railway tracks and the storage bin was placed up high enough so that material would be discharged from same direct to cars.

Figure 19 shows plainly the conveying pipe lines passing on in three different directions, and the first part of one of these is shown running parallel with gas flue, and intake connections are located at suitable intervals for flexible hose with special material intakes, which latter can be placed under settling hoppers from where material is to be drawn. A continuation of this line is shown in figure 20, and the special intake and hose is plainly visible in the foreground. The blue fume is now carried through this pipe system, automatically, without traces of dust loss at any point, without labor or trouble of any kind, to the collecting station, and is automatically discharged into bins and is easily loaded to cars for shipment.

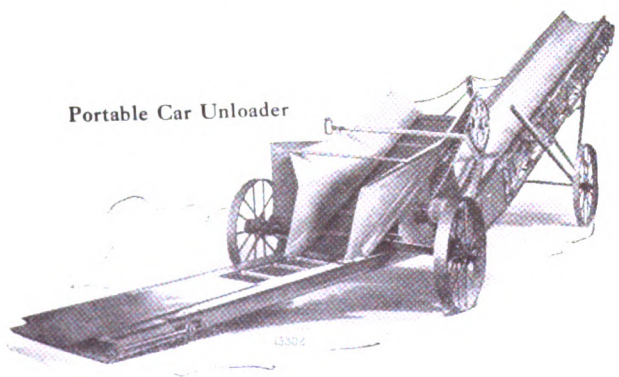
While most of the material previously mentioned is of a fine pulverized nature, it does not necessarily mean that this is the only class of material that can be conveyed pneumatically. Figure 21 shows actual size of phosphate rock now being handled in a 4" diameter hose at the rate of 30 tons per hour. Figure 22 shows how the nozzle is placed in the material, and how the pile gravitates to the nozzle as the unloading ad-

(*Continued on page 80*)





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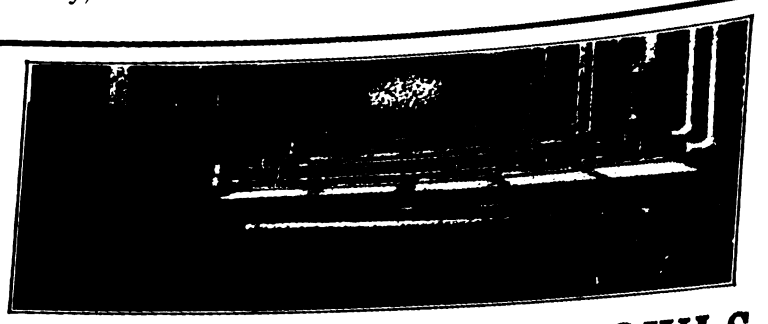
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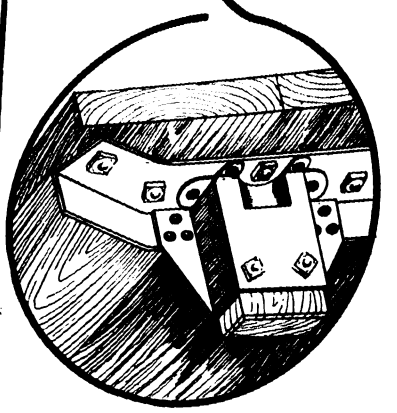
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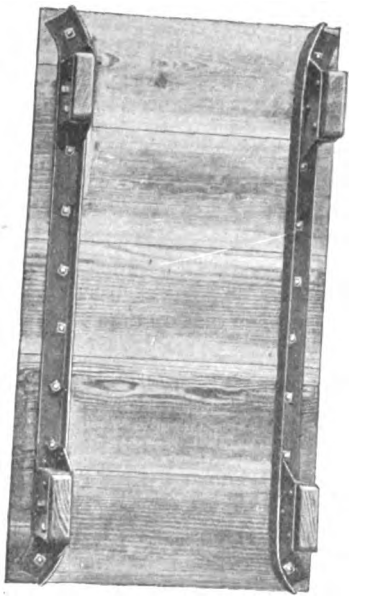
Hydraulically driven rivets, instead of bolts, hold the steel leg supports to the runners.

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Don't overlook this when comparing platform values.

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(*Continued from page 78*)

vances. It is only necessary for the man to keep the nozzle submerged in the material, and he is not required to do any shoveling or cleaning in order to unload the barge entirely.

Although considerable progress has been made, and undoubtedly more compact equipment has been developed in this country, there are more extensive installations of pneumatic conveying equipment in England than here. The apparent reason for this seems to be that the existence of old buildings and plants in that country does not adapt them so well to the installation of other types of conveyors, consequently the plant executives have gone further into the investigation of the value of pneumatic conveying, thus encouraging the manufacturers of the equipment.

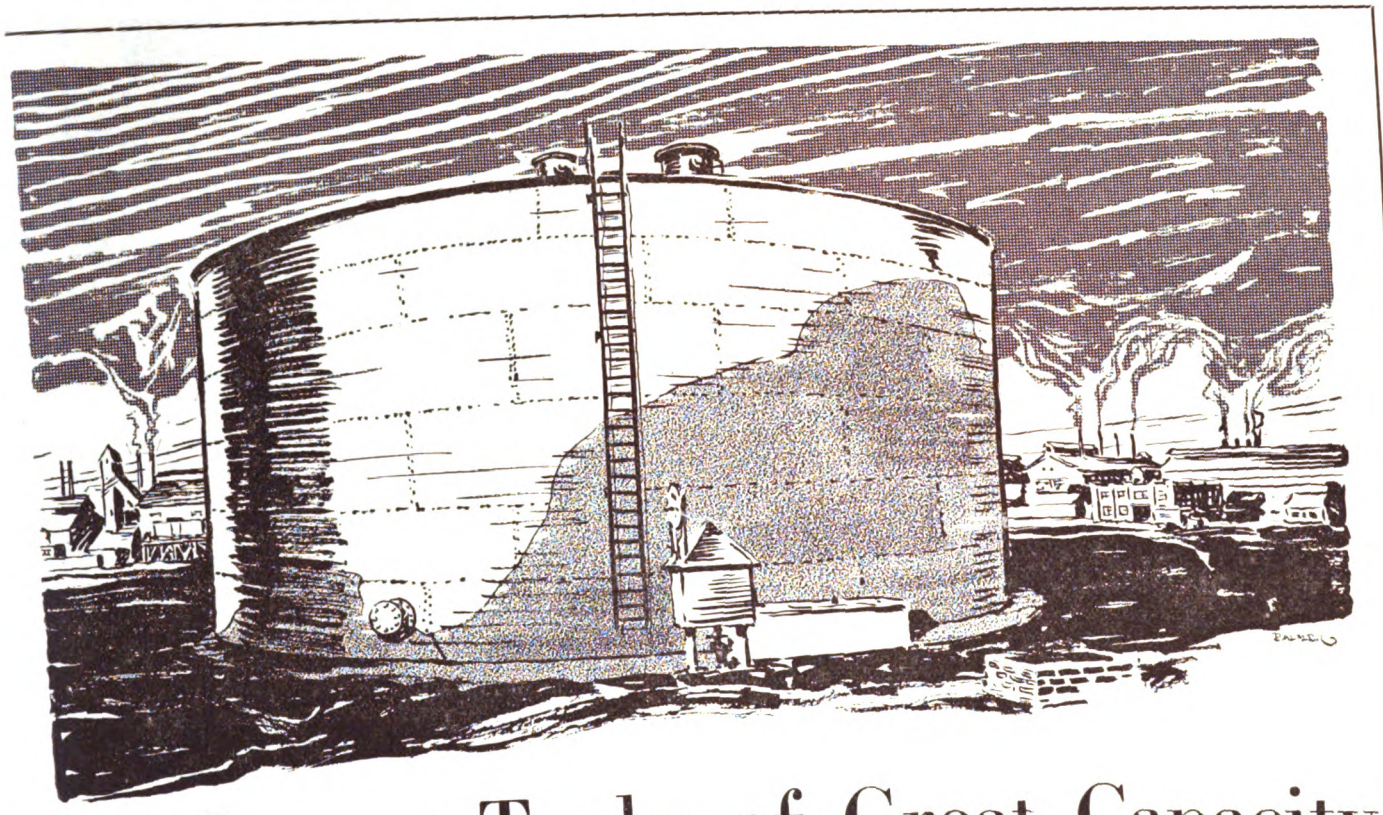
To illustrate this point, we are showing a floating pneumatic transfer plant, for transferring grain from ship holds to barges. Grain especially lends itself admirably to pneumatic conveying, because it is easy in flow, regular in size, and practically self-feeding. This possibly has much to do with the large tonnage which can be handled by this plant, namely, 200 to 250 tons per hour. The diagram is self-explanatory. To the left is the ship which is being unloaded, while to the right is the barge which is being loaded, and between the two is the transfer plant. A represents the special suction nozzle through which the grain enters the system, together with the free air which acts as the conveying medium. B is the length of flexible hose to enable the nozzle to sweep the width of the barge, the length being dealt with by moving the boat to within the radius of the swivel arms. C is a permanent pipe carried on the jib arm, which is mounted on a swivel joint. D is another large flexible pipe to permit of the swivelling already mentioned. F indicates the receiver into which the grain is deposited, and G the special rotary valves for releasing the material from the system without interfering with the vacuum of the conveying line. J indicates the connecting pipes of the receivers, air filters and pumps, and it should be noted that they are considerably larger than those on the suction end, C; this being necessary to allow for the expansion of the air under vacuum. K is the reciprocating pump driven from a power engine, M, through large helical gear wheels which act as fly wheels and help in equalizing the torque required by the pump. L is the outlet pipe for the air as it is exhausted from and by the pump.

This plant is simple, but every possible modification can be added that circumstances may render desirable, such as discharging to a belt conveyor for feeding the silos or other storage points.

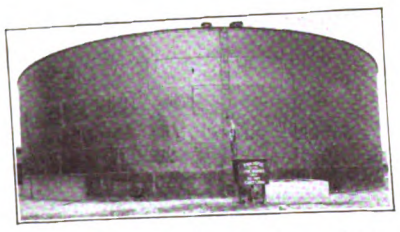
The pneumatic system of transportation has many advantages over mechanical conveying. These may be summarized as follows:

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(*Continued on page 82*)



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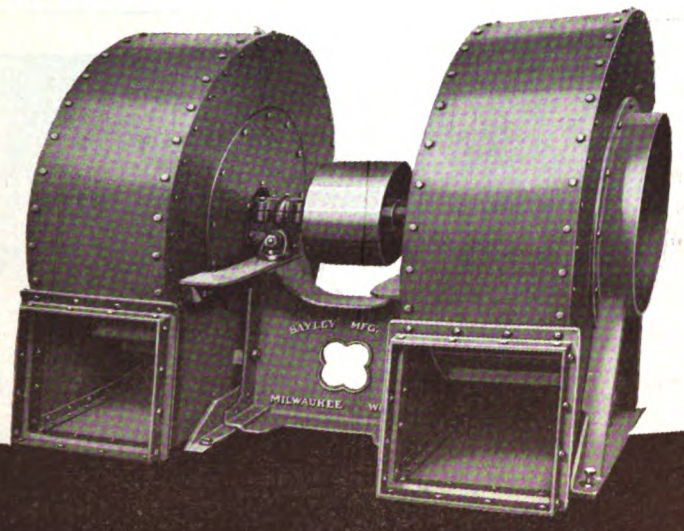
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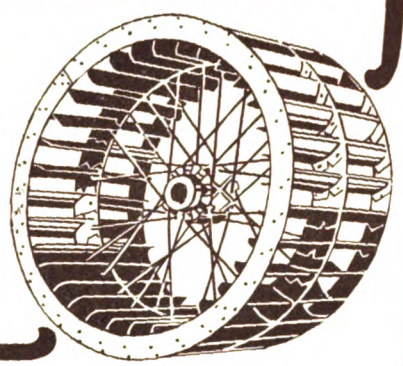
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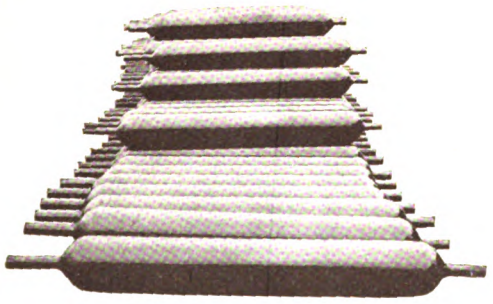
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SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Whenever rollers are used, Conveying Systems, Steel Mill Tables, and the like, maximum neck-strength is required because here the strain is most severe. Wharton rollers are made in one-piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained.

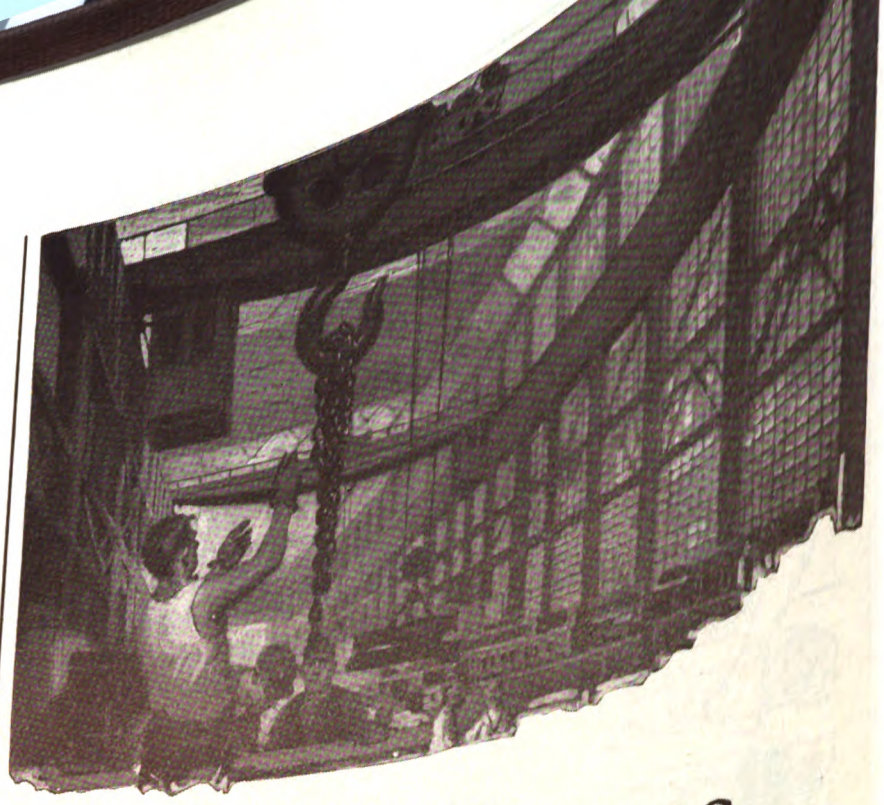
Yet, because they are hollow they are light in weight—saving in freight—easy to handle—lower power cost. Built only on order to meet customers requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.



Cross-Section Showing
Hollow Construction

Wm. Wharton Jr. & Co., Inc.
(Founded 1859)
30 Church Street, New York, U. S. A.
Cable, Whilwharton, New York



P & H Cranes

SINCE the first three-motor electric traveling crane was built—in the P & H shops 30 years ago—there has always been one big outstanding feature—Dependability. And this applied to both the product and the company. P & H Cranes and Hoists—(over 7000 in use)—stand up under the most severe and continuous service, whether in steel plant, foundry, railroad shop or other industrial plant.

We are firmly convinced that there is no crane in the world capable of steadier, more dependable performance.

P & H quality of design and construction—the care in selection of all materials—such extra efforts as the re-rolling of all plates in our own plant—our "renewal from stock" service—and standardization—insure the added service and dependability that you get when you buy P & H Cranes.

The fact that the buyer never needs to justify his selection is an indication of how the industrial man and engineer look upon P & H Cranes.

Crane and Hoist Division

PAWLING & HARNISCHFEGER CO.
Established in 1884
3850 National Avenue, Milwaukee, Wis.

New York
Pittsburgh
Phoenix
Los Angeles
Salt Lake City
Chicago
Philadelphia
Denver
San Francisco
Portland
St. Louis
Birmingham
New Orleans
Atlanta
Seattle

P&H CRANES and HOISTS

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If we would save you 50% on the cost of the soap

used in your employees' wash rooms and would prove it to you, and at no expense to you whatsoever, it would interest you, wouldn't it? We can.

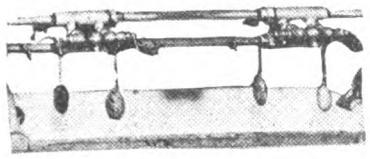


This type is by far the best for this style washstand, but requires a 9-16" hole to allow the weight to hang below in order to permit the soap to be carried to the water.

Having by far the most economical method for the using of toilet soap in your employees' wash rooms our only desire is to have you afford us the opportunity to prove it for you which we will do by sending you fixtures to equip your wash room and with them send a sufficient quantity of soap to give it a thorough trial and this trial will cost you nothing—neither will it place you under any obligation to us whatever.

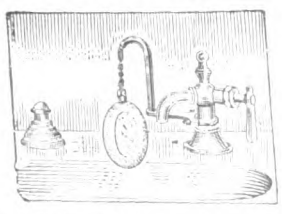
As a trial will be more convincing than all the sales talk we can advance, just write us how many fixtures you desire and we will send them with soap at once.

One of many types



This style is fastened to either the faucet or pipe, and if used on pipes as per cut place it close enough to faucet to allow soap to be carried under the water when in use and far enough away so soap will escape flow of water if left running.

Another type



This style just clamps on faucet and does not need plumbing in the least and is very easy to install and take off but soap does not pull down as the sliding chain does.

We manufacture fixtures to meet any condition and style of wash bowls and they are leased free for the using of our soaps which are the Antiseptic Cream, Ambro Pumice and Tar.

Write today for full details

ANCHOR CORE ECONOMY SOAP CO.

136 West Lake Street, Chicago, Ill.

(*Continued from page* 80)

buildings, roads, rivers, railways, etc., are all overcome easily, since the conveyor is "only a pipe."

Should circumstances not permit of a straight single run for such appliances as bucket elevators, screw conveyors, etc., plant executives would do well to consider the use of pneumatic conveyors, because the pipe is simple to install, and it can be carried up or down, around corners, over or under roads, etc. Cranes, hoists, telphers, belt conveyors, all have their special sphere of usefulness, but no other method can claim all the advantages of the pneumatic system as outlined above. Enough has been said to show that pneumatic conveying has made great progress and that the possibilities of this method of dealing with the moving of solid materials are much greater than has been generally recognized.

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

WHAT PAINT MEANS TO MAINTENANCE

Willard C. Beach Air Brush Co.
Debevoise Paint Co.
Detroit Graphite Co.
De Vilbiss Co.
Paaschke Air Brush Co.
Pratt & Lambert, Inc.
Sherwin-Williams Co.
The Tropical Paint & Oil Co.
Truscon Laboratories
Vortex Mfg. Co.

SYSTEMS AND APPLICATION OF PNEUMATIC CONVEYING

Allen & Billmyre, Inc.
Ashwell & Nesbit, Ltd., London, England
Dust Recovering & Conveying Co.
Eureka Sales Co.
H. J. H. King & Co., Gloucestershire, England
Lamson Co.

FIGHTING FRICTION IN THE MODERN POWER PLANT

S. F. Bowser & Co., Inc.
The De Laval Separator Co.
The Green Fuel Economizer Co.
Ingersoll-Rand Co.
B. F. Sturtevant Co.

MAKING LABOR APPRECIATE THE LABOR-SAVING IDEA

The Cleveland Crane & Engineering Co.



Guarding everything but —the big thing!

ONE manufacturer has said that he looks upon his boiler room as a separate factory where coal and water are the raw materials and steam is the finished product. Is it necessary to add that his furnaces are equipped with mechanical stokers?

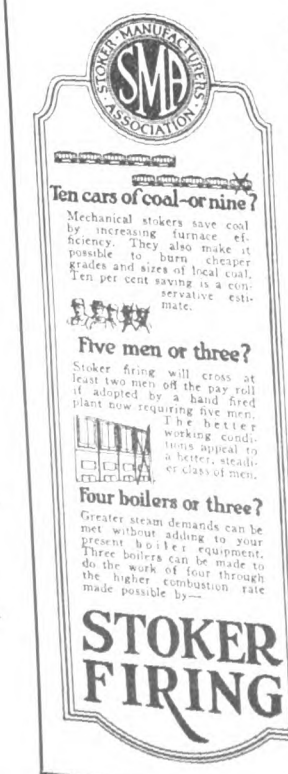
This man has felt the inconsistency of keeping the materials used in manufacturing in an orderly stock room where the smallest odds and ends can be had only with a properly signed requisition—and then in square contradiction of this policy of efficiency, allowing ton after ton of coal to be thrown into furnaces without a thought about how much is wasted.

An installation of mechanical stokers, and the expert engineering counsel that is a part of every stoker installation, deals a death blow to the old order of burning coal regardless of the savings possible.

The great economy of fuel, the saving of labor, and the centralizing of responsibility in a few well trained men, invariably puts the stoker-fired power plant on a business basis.

It becomes a real productive department instead of the profit-dwarfing item of overhead that it was when the plant was hand fired.

Why stoker firing pays—why coal is the logical fuel and how to burn it—is the subject of a free book, "Coal—the *Basic* Fuel." Where shall we send it? A card addressed to the secretary of the association brings a copy to you.



Write for this book — *It's free of course*



BURN COAL
The basic fuel

STOKER MANUFACTURERS ASSOCIATION

G. A. Sacchi, Secretary, Lester Branch, Philadelphia

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Building 50,000-Horsepower Turbo-Generators

(*Continued from page* 18)

of the building, the two side bays having first and second mezzanines.

Standard gage railway tracks enter the south end of the east and west main bays, extending some two car lengths into the building and forming the shipping points. Narrow gage electric tracks enter the building at numerous openings on all four sides and cross all five bays from east to west at two places.

The main bays house the enormous tools required to machine turbine and generator parts (which may run in weight to forty or fifty tons and in diameter to as many feet). The main bays also house the test floors. In these two bays are 29,500 square feet of iron floor plates. The larger portion of these are erecting stands or test floors; the remainder are machine department floor plates where huge portable tools are brought to that work which is too heavy for economical transportation. The east and west side bays on the ground level are devoted to the machining of parts of more moderate weight and size, the east bay being particularly devoted to boring mill work on bucket wheel discs. A turbine may contain from thirteen to twenty-three of these discs, varying in diameter from four to eight feet and each turned from a solid forging of special alloy steel.

There are 987 machine tools in building No. 60 not counting small grinding stands and drill presses, and there are more than thirty-five overhead traveling cranes of capacity ranging from two to one hundred tons.

Some statistics regarding the size of a fifty thousand kilowatt unit may be of interest in helping the reader to visualize the scale on which operations are conducted. The turbine generator of this capacity has an over-all length of approximately 64 feet, a width of 24 feet and a height of seventeen feet above the floor line. The total weight of the steam turbine is 730,000 pounds, of the generator 441,000 pounds, and of the complete unit, 1,171,000 pounds or over 500 tons. The turbine shaft alone on a unit of this size weighs 27,000 pounds; the largest casting, the lower part of the exhaust hood, 85,000 pounds, and the rotating field of the generator weighs 205,000 pounds.

The length of the rotor generator shaft is slightly more than 37 feet and its maximum diameter over the body 74½ inches.

Naturally in work as extensive as in building of huge turbine generator sets, information must come from the engineering department piece-meal. It is estimated that approximately twenty thousand individual sheets of drawings are required in a case of a fifty thousand kilowatt set, including of course the drawings for the various special nuts, bolts, fittings, etc. Many of these are standard and therefore do not require redesigning for each order, but the steam, electric and conditions vary so greatly ferent cases that a multitude new drawings are as a rule quired on each manufacturing order. The parts which take the longest time in their processing are naturally gotten out first

WORTHINGTON

The Unaflow Compressor

FEATHER VALVES

(Reg. U. S. Pat. Off.)

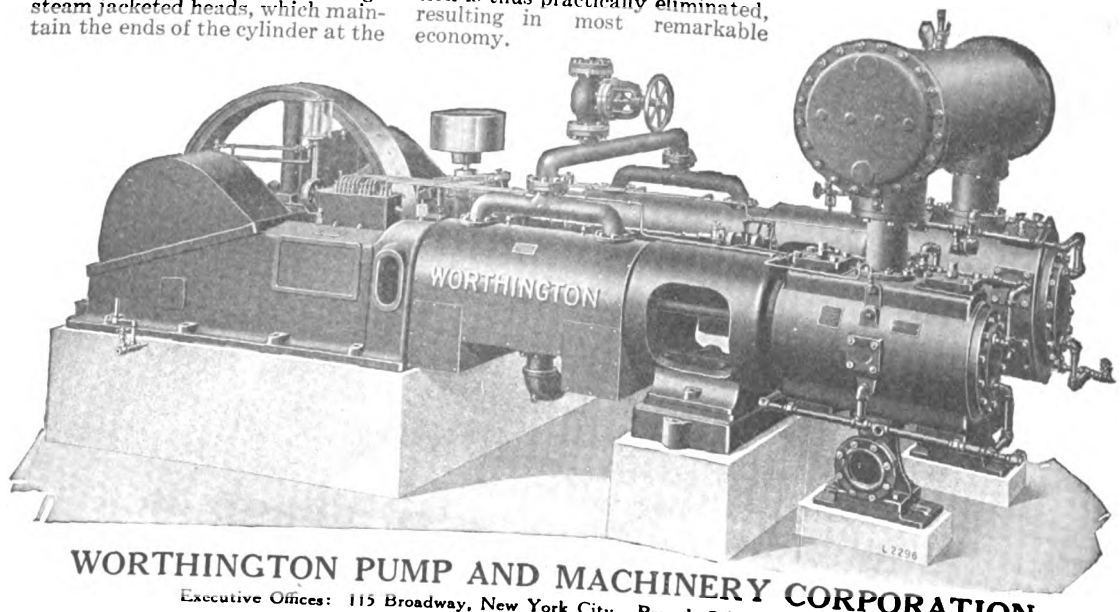
Unaflow Steam Economy

The Worthington Unaflow Air Compressor uses forty to fifty per cent. less steam than a slide valve machine and outstrips Meyer Gear economy by a wide margin. A 1,500 cubic foot capacity Unaflow compressor will save $775.00 in coal cost for one year as compared with the Meyer Gear. Certainly such savings are worth investigating. Bulletin L-542 tells the whole story.

UNAFLOW ECONOMY

Engine economy is largely a matter of reducing or eliminating cylinder condensation. In the usual engine, the steam counterflows, or travels back over its own path. Contact surfaces, such as heads, cylinder walls and ports are subjected alternately to live and exhaust steam, and as a result these chilled surfaces cause great initial condensation of the entering steam.

In the Worthington Unaflow, the steam is admitted through steam jacketed heads, which maintain the ends of the cylinder at the temperature of the live steam. The steam expands away from the cylinder head, and exhausts through central exhaust ports, uncovered by the moving piston. The steam does not counterflow, and thus the cool exhaust does not flow over those parts coming into contact with the entering steam. The entering steam is not chilled, but comes into contact with surfaces of a temperature quite equal to its own. Cylinder condensation is thus practically eliminated, resulting in most remarkable economy.



WORTHINGTON PUMP AND MACHINERY CORPORATION

Executive Offices: 115 Broadway, New York City. Branch Offices in 24 Large Cities

WORTHINGTON

W-260.8

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works *East Cambridge, Mass.*
Worthington Works *Harrison, N. J.*
Laidlaw Works, *Cincinnati, Ohio.*
Hazleton Works, *Hazleton, Pa.*
Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works *Cudahy, Wis.*
Snow-Holly Works *Buffalo, N. Y.*
Epping-Carpenter, *Pittsburgh, Pa.*

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Save 3 to 5 Men

With SPRACO Industrial Finishing Equipment

Applicable to all kinds of surface coatings on all kinds of miscellaneous manufactured commodities.





Finer Finish!

Greater Speed!

Lower Cost!

Demonstrated and proved superior to all other finishing room methods.



Paint the "SPRACO" Way

Use SPRACO Portable Equipment for all upkeep work on Factory interiors and exteriors. Saves whole weeks in time. Saves thousands of dollars in maintenance costs.

Write for SPRACO Bulletin of Prices, details and descriptive data.

Dept. P-86

SPRAY Engineering Co.

60 High St. Boston, Mass.

SPRACO BOSTON

from the drafting room. The high pressure shell of a large unit requires anywhere from thirty-five to fifty weeks in the shop between its entry as a rough casting and its debut on the "steam date." The field shaft with its coils, retaining rings, etc., requires even more time. Information and drawings for such parts come first on the manufacturing instructions, while later additions, spread perhaps over a period of from four to six months inform the shop departments as to the identity and nature of other parts required in the unit which take less time to complete.

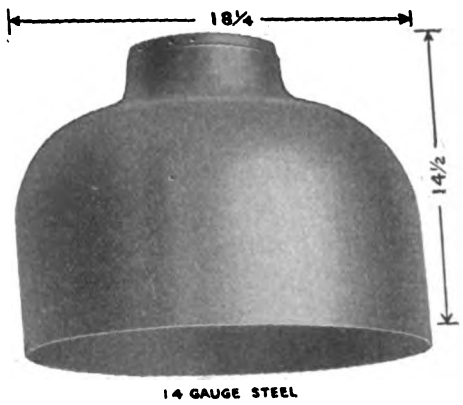
It is the practice in scheduling the production of the various parts of one of these large units to work back from what is known as the steam date, which as its name implies is the date set by the production office for the first admission of steam to the erected turbine.

For the past two years the sizes of the turbine generator units produced at Schenectady have grown larger and larger. A thirty thousand kilowatt set is today regarded as merely of average size, whereas two years ago it was a veritable monster. Today, fifty thousand kilowatts capacity is the average upper limit, although units have been built of slightly greater rating. The day of the 75,000 and 100,000 kilowatt unit is probably not far off.

Not only have the upper limits in capacity been thus extended, but the average sizes of all units represented by the work-in-process have become larger. Ten thousand kilowatts is approximately the smallest unit now built at Schenectady. Sets of less capacity than this made by the company are now being built at the Erie, Penn., plant.

As a commission from Governor Gifford Pinchot, a power survey of the state of Pennsylvania has just been instituted by the Commercial Engineering Department of Carnegie Institute of Technology. Dr. W. F. Rittman, head of the department, and Professor Sumner B. Ely are making the survey under the directorship of Morris L. Cooke, of Philadelphia.

The purpose of the study is to determine the approximate consumption of horse power necessary to operate Pennsylvania industries over a given period of future years.



Stronger and Lighter than Cast Iron---

Now Pressed from 14 Gauge Steel

This pump head was formerly made of cast iron. It is now **Pressed** out of 14 gauge steel. By turning this work over to us the manufacturer found that Pressed Steel Parts are stronger, lighter, look better and cost less than he could make them in his own plant. He is saving time and money and is utilizing his own equipment on more profitable work. Lower production costs and increased volume were gained.

Send us a sample or blue prints. We can show you how to effect similar economies and save you time and trouble by replacing forgings and castings with Pressed Metal Parts.

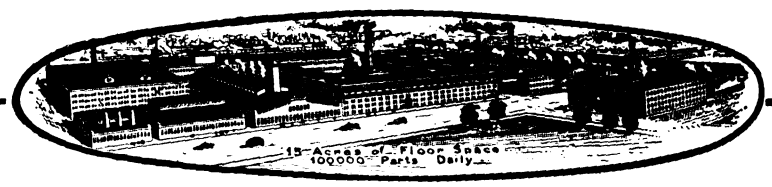
We have specialized for more than 42 years in this work.

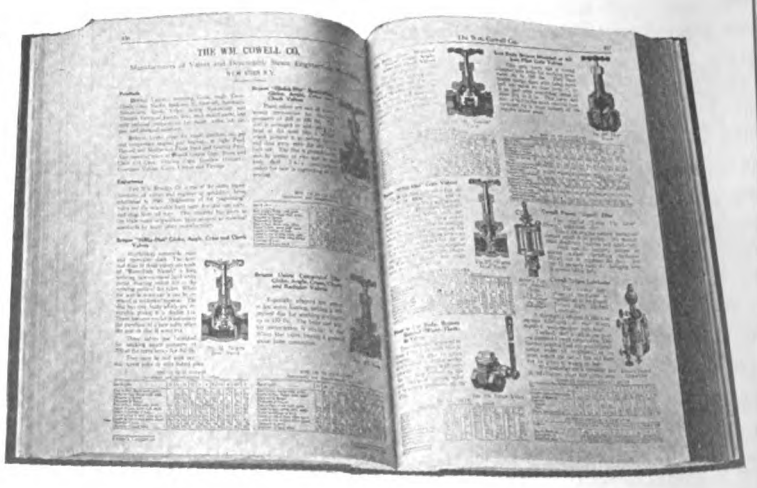
We draw, stamp, punch, form, spin and blank the following sheet metals—Aluminum, Brass, Copper, Nickel, Zinc, Monel, Sheet Steel, Tinplate, Sheet Zinc, and we have facilities for electric spot and butt welding, hot tinning, hot galvanizing, japanning and porcelain enameling.

Geuder, Paeschke & Frey Co.

1457-1750 Canal St., Milwaukee, Wisc.,

352-358 W. Ohio St., Chicago, Ill.





For the buying facts regarding

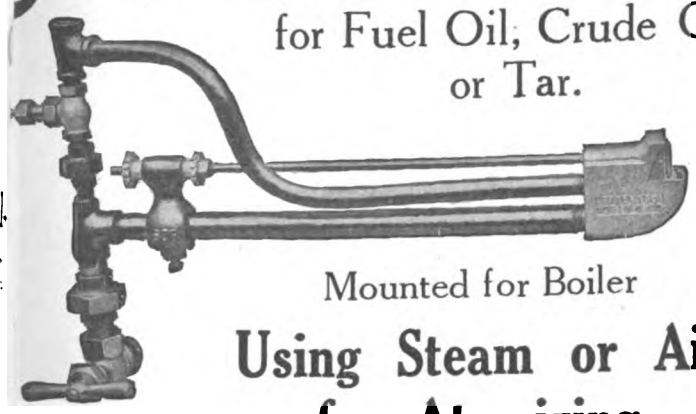
INDUSTRIAL and POWER PLANT MATERIALS and EQUIPMENT

See SWEET'S ENGINEERING CATALOGUE

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ALOREX Burners

for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



ALOREX
nmounted

ote direction of arrows, air or steam meets the at right angles, thus oughly atomizing the xternally. This prevents *nging or Carbonizing* burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

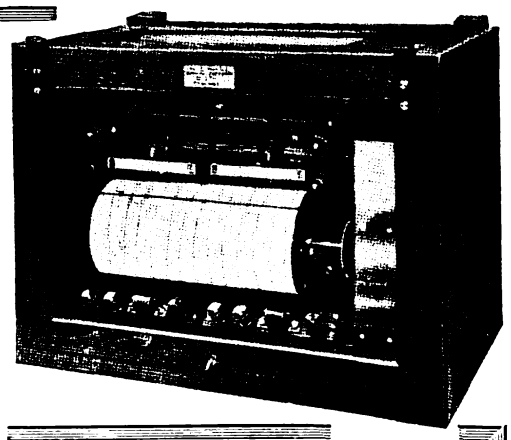
The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

Write for catalog.

W. N. BEST Corporation
Broadway ENGINEERS IN CALORIC NEW YORK
ere is nothing better than the Best

MBRIDGE ECTRICAL CO_2 CORDERS DICATORS



Three Essentials in Boiler Room Recorders

ACCURACY—The improved design and principle of Cambridge Electrical CO_2 Recorders and Indicators make them accurate to a high degree as well as rapid in action.

SIMPLICITY—Cambridge Recorders are entirely electrical—no chemicals to renew. Four CO_2 percentages are shown on one chart, which means four independent readings from four boilers on one chart. This feature saves time and lessens possibility of errors.

RUGGEDNESS—There are no glass or rubber parts in Cambridge Recorders to break or wear out. These unusually rugged instruments can be installed any distance from the flue.

Cambridge Electrical Recorders and Indicators are furnished in a number of ranges to cover practically all boiler room needs.

Other Cambridge Instruments—Electric Distance Thermometers, Thermo-electric Pyrometers, Optical Pyrometers, Pressure Recorders, Draft Gauges.

Write for List No. 157-F, containing interesting data.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC.)
MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

Bethlehem Shipbuilding Corporation, Ltd.

MOORE PLANT

E. H. SWEETZ, General Manager

Elizabeth, New Jersey

May 13, 1923.

IN REPLY REFER TO RJMW:MC

The Crescent Truck Co.,
Lebanon, Penna.

Gentlemen:-

Att. Mr. P. W. Smith, Secretary.

Replying to your recent inquiry regarding the Crescent Industrial Trucks, at the Moore Plant, advise you that they have been in operation for the past several years and have given excellent satisfaction.

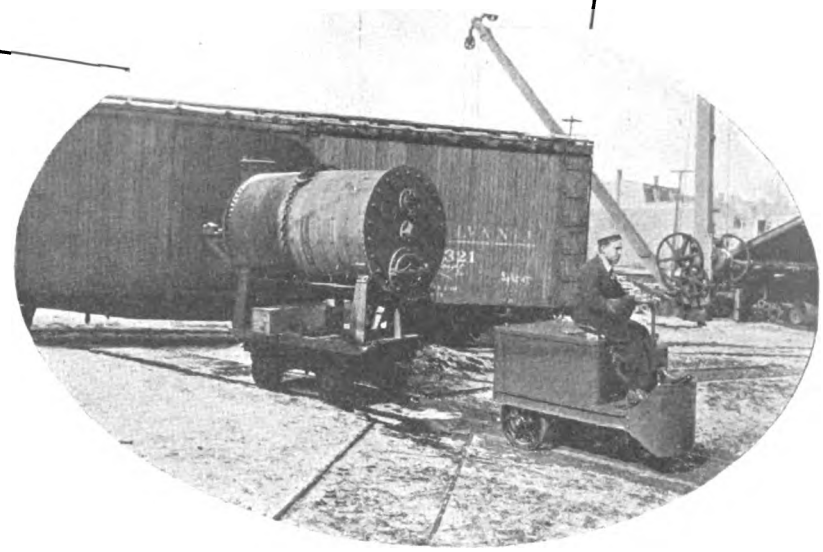
We have no definite record of the former cost of mas-handling of materials which operation was supplemented by the electric trucks, but we have from time to time made tests, observing the comparative cost of handling materials and have found that with due consideration to the cost of upkeep and operation of the Storage Battery Trucks, they have proven considerably more economical [illegible] of material conveyed and as to the speed at which the work was accomplished. The electric trucks have become a necessary part of our transportation system.

The writer would be pleased to receive descriptive matter covering the latest types of trucks.

Yours very truly,

BETHLEHEM SHIPBUILDING CORP., LTD.
MOORE PLANT

Plant Engineer.



"Considerably More Economical" Says this Fleet Owner

Crescent Electric Industrial Trucks are proving themselves more economical wherever the problem of moving goods is confronted. They are being used for all purposes from receiving raw materials, right through every manufacturing operation, to the shipping platforms.

To cover every possible need, we build various models; but each model was designed and built only after exhaustive tests under actual operating conditions demonstrated its need and worth.

Some of the largest plants in the world are now operating large fleets of Crescent Trucks—American Can, Bethlehem Shipbuilding, Bush Terminal, General Electric—to mention a few.

Our engineers will be glad to call and point out—without obligation—just where the use of Crescents in your plant will save time and money.

Our catalog—well illustrated—may have some ideas for you. Send for it.

CRESCENT TRUCK CO.
165 No. 10th St., Lebanon, Pa.

International General Electric Company, Export Agents

TRUCKS CRESCENT TRACTORS

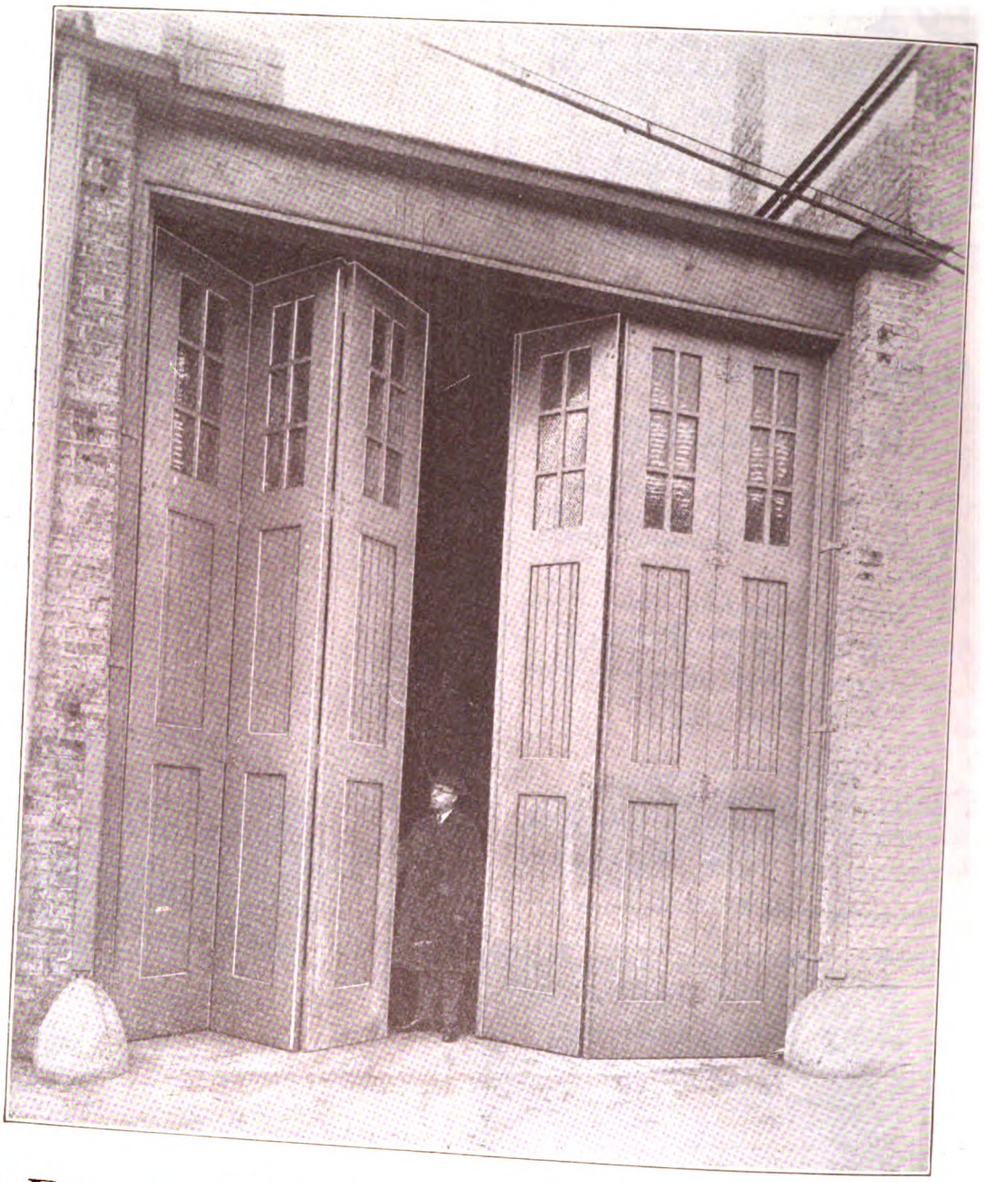
CRESCENT
ELECTRIC TRUCKS & TRACTORS

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RICHARDS-WILCOX R-W AURORA TRADE MARK



Quality leaves its imprint



The Biggest Doors are Easy to Handle When Hung On Slidetite Industrial Door Hardware

DOORS of extra large size are frequently necessary in industrial plants it is comparatively simple to construct big doors, it is a real pr hang them satisfactorily and permanently.

"Slidetite" Industrial Door Hardware has successfully solved this pr numerous instances. A typical "Slidetite" installation of this kind is th J. A. Torstensen Company, Chicago, shown in the illustration above. Th are 21 feet high to permit trucks loaded with large lights of plate glass through. These doors move smoothly and easily in spite of their great and bulk.

Doors hung on "Slidetite" slide and fold completely out of the way, lea unobstructed opening up to 30 feet wide if necessary. Require no tinke they never sag or bind. Easy to open, even in a high wind, and cannot p slam shut. Close tight, snug and secure.

Write to Department V for full particulars regarding "Slidetite." Our neering Department is equipped through wide experience to assist yo suggestions and plans. Bring your door problem to us

New York
Boston
Philadelphia
Cleveland
Indianapolis
St. Louis

Richards-Wilcox Mfg. Co.

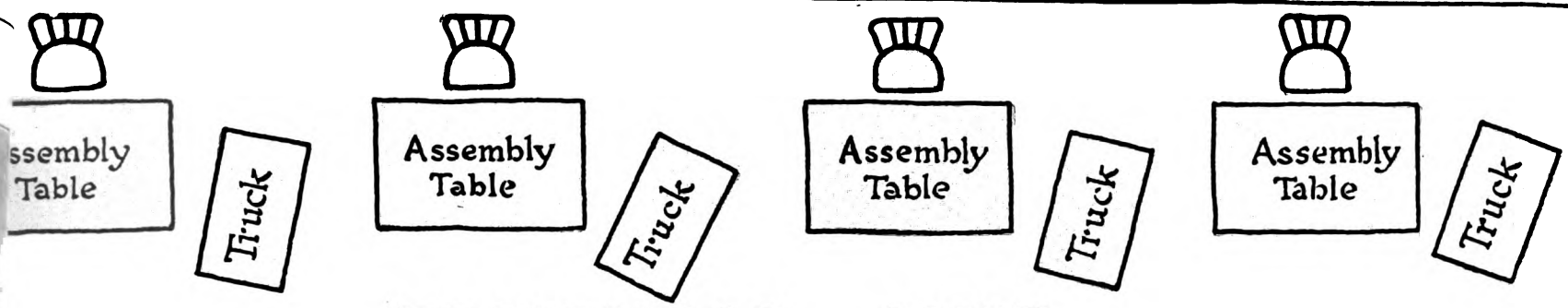
"A Hanger for any Door that Slides."

AURORA, ILLINOIS, U.S.A.

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Winnipeg LONDON, ONT Montreal

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Minneapolis
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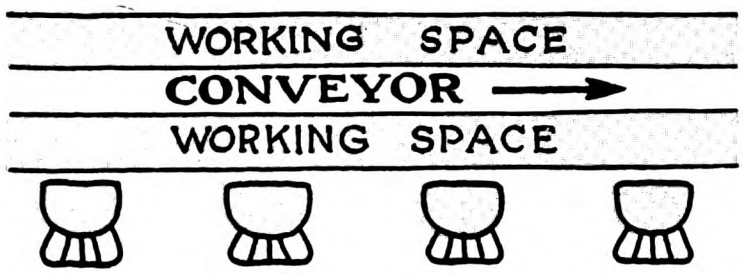
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Costly, space-wasting assembly method for four operations



embly conveyor for radio parts in- the production five-fold, and cut e space occupied in like proportion.



Labor, time and space saving assembly method for same four operations



15% labor saved, and finished stock reduced by 100,000 instruments is the record of this system, in an automotive parts plant.

Modern assembly methods

INDUSTRIAL plants everywhere are adopting a new and better assembly method—a plan that is cheaper; that saves space, time, and labor.

The pictures tell the story. Gone are the assembling tables sprawling over valuable floor space, with the accompanying waste of area for trucks and trucking aisles. Instead, the product is carried past the workers on a compact conveyor and work bench unit, which occupies only a fraction of the costly space that was required by the older, wasteful method. Often, more material can be assembled along a forty foot conveyor, than could be assembled under the old plan, in an area forty feet square.

The economies, in every line of business are almost unbelievable. An automobile company turned out the same production with 20% less workers. A vacuum cleaner company employs only 4 men on assembly work, where 10 were formerly required. A shoe company cut the time of manufacture from 18 days to 4½ days. A glass manufacturer saves $27,000 a year in labor alone from a $15,000 conveyor system, and states that this direct labor saving is only one of the many advantages. A rubber goods manufacturer cut his assembly force from 18 to 11 men, on an investment of only $1,500. These are not exceptional cases, but are the regular, day-to-day savings that may be expected from any installation of assembly conveyors. You can very likely make similar savings in your business. There is no plant investment that pays greater or surer dividends.

Part of the service that we offer is to help you discover the great opportunities for saving that we are confident exist in your own plant. Our engineers will study your problem; they will help you plan a conveying system to give you the greatest returns for the smallest investment.

These same men who planned the conveyors mentioned above will help you to solve your problem. They will apply the same principles in your plant that have made such large and profitable returns in the plants of others.

There is no obligation. We shall be glad to make a service analysis for any executive who stands ready to install the necessary equipment, should worth-while savings be indicated. In requesting this work, please ask specifically for a Lamson Service Analysis of your plant.

THE LAMSON COMPANY
SYRACUSE, NEW YORK
Branches in the principal cities

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SHEPARD ELECTRIC

LIFT ABOUT savings like these for your business



One man does the work of four— $2,500 a year saved

"Cutting down truck loading and unloading time, eliminating congestion, and saving 3 men, are some of the results of installing a Shepard *LiftAbout* in our business. A year ago we purchased a Shepard *LiftAbout* to load and unload leather materials from our trucks—and one man with the Shepard does the work of four men—a yearly saving in money of $2,500.00.

"The *LiftAbout* runs on a single rail overhead from the loading platform, past a scale and into a corner of the building —a total distance of about 60 feet. A truck backs up to the door—and the *LiftAbout* lifts off or loads the bundles or rolls. We unload leather sides, centers, and insole leather weighing 190 or 200 pounds to the bundle—and we load finished machinery belting which comes in rolls weighing from 100 to 500 pounds depending upon the strength and size of the belting. Some outgoing shipments of curried leather weigh 1000 pounds."

From report by J. H. Lang, President of the Fried-Lang Leather Co., New York City.





Takes place of elevator and saves $2,200

"Our raw paper, from which we manufacture tickets and tags, comes in 500-lb. boxes. These were formerly raised to the second floor in a hand operated elevator. It took 2 men 15 minutes to unload a box, load it on the elevator, raise it to the second floor, and unload it. As these boxes often come 25 at a time, they held up production because we couldn't use the elevator for other purposes while it was hoisting paper, and labor was taken from other work.

"Now we are using a Shepard *LiftAbout* running on an I-beam along the second floor ceiling and extending outside the building. It takes only 3 minutes for one man to unload and hoist a box of paper, which saves $108 a year in labor alone.

"But the biggest advantage is giving more even production and freeing the elevator for other purposes. If we had been obliged to continue using elevators, we should have had to put in a power elevator costing $2,500. The Shepard hoist saved us $2,200 in investment, and costs less to run than an elevator.

"We also saved $150 over the cost of another make of hoist we were considering. The Shepard was purchased because it was recommended as the hoist that needs the least attention. *It has made good, beause in 6 months' use it has not lost a minute or cost us a cent for repairs.* The manufacturers give good service and look after their users."

From report by Geo. W. Thomas, Asst. Supt. of the Soabar Co., Philadelphia.

Car unloaded in three hours— formerly it took two days

It seems almost unbelievable that so much time could be saved—but such economies are quite common in plants where the *LiftAbout* is moving and lifting loads.

Car loads of pipe, fittings, radiators and other material handled by Conran & Sons are received on this Company's own siding. The volume of business done necessitates the quickest possible unloading of cars and the clearance of siding for more shipments.

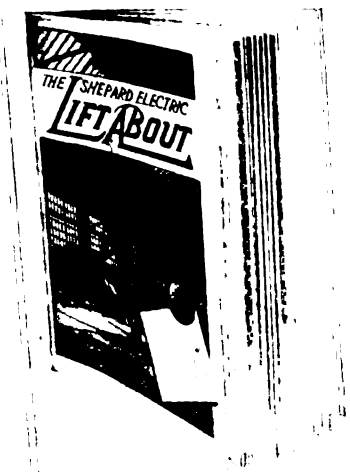
Previously three days was the average length of time required to unload, with four to six men doing the work.

Now, with the *LiftAbout* a car shipment is disposed of in three hours with the services of but two or three men. Men formerly needed on handling work are released for more productive activity.

The hoist has been a contributing factor in increasing the morale of the men—they are contented and happy, and now enjoy work that heretofore was depressing both physically and mentally.

Report based on interview with M. E. Conran & Sons, Brooklyn, N. Y.

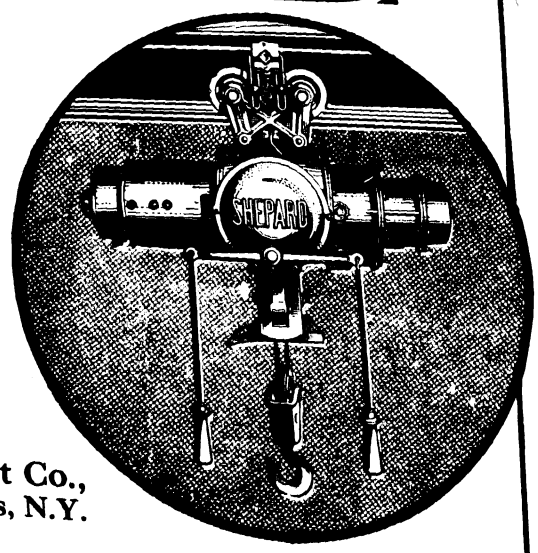




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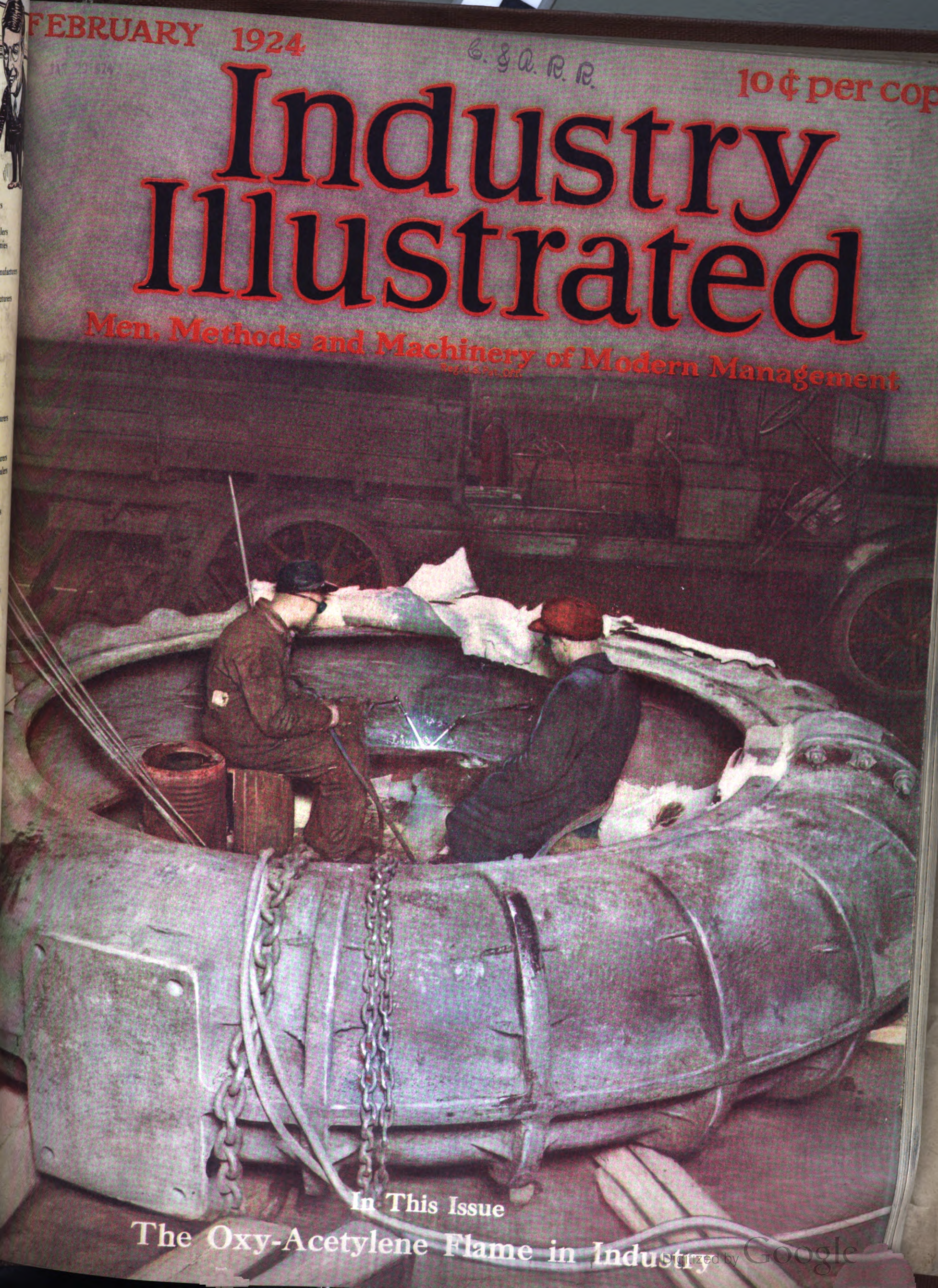
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In This Issue

The Oxy-Acetylene Flame in Industry

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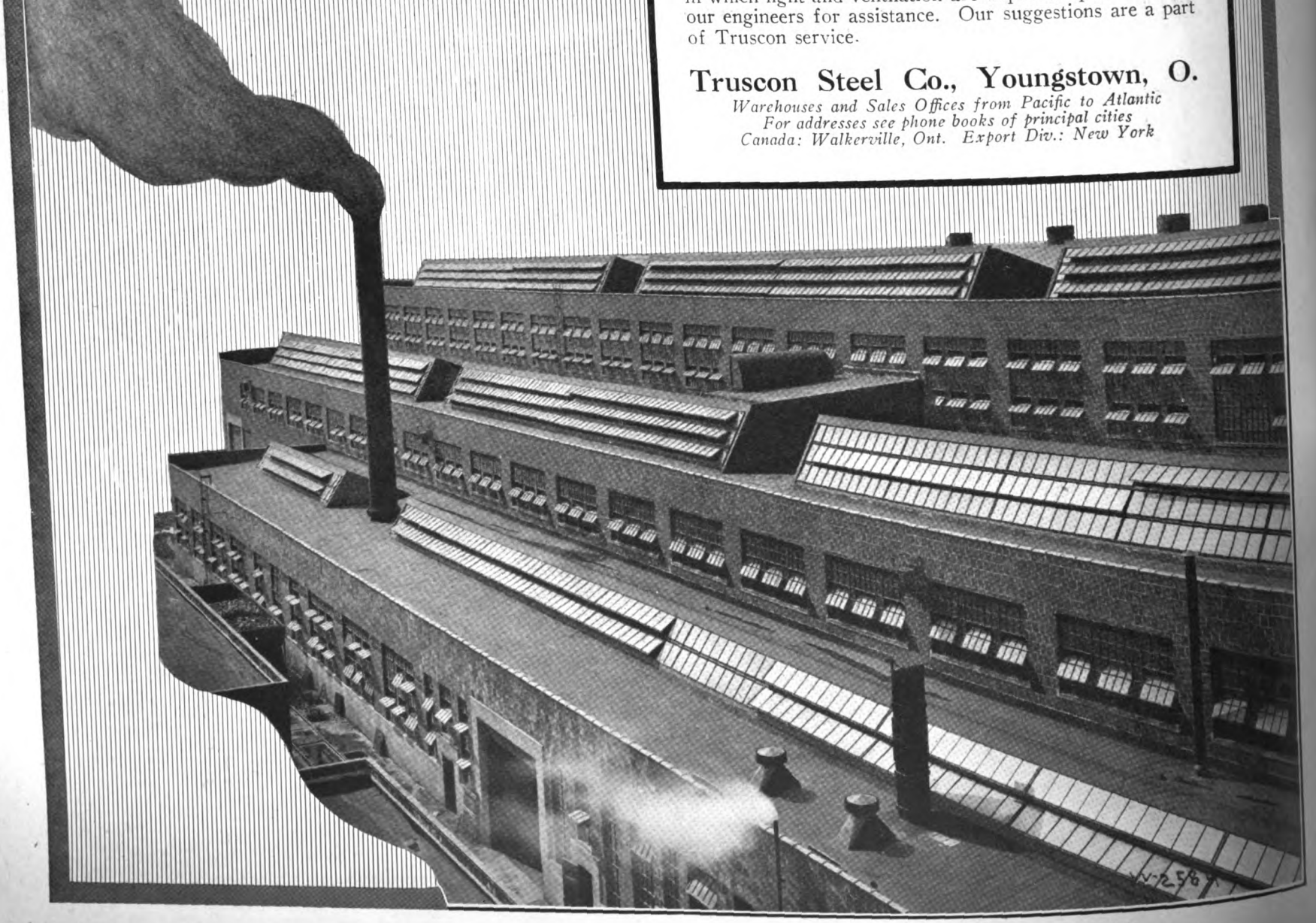
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With all their advantages the cost of Truscon products is extremely moderate. If you have a building problem in which light and ventilation are important points call on our engineers for assistance. Our suggestions are a part of Truscon service.

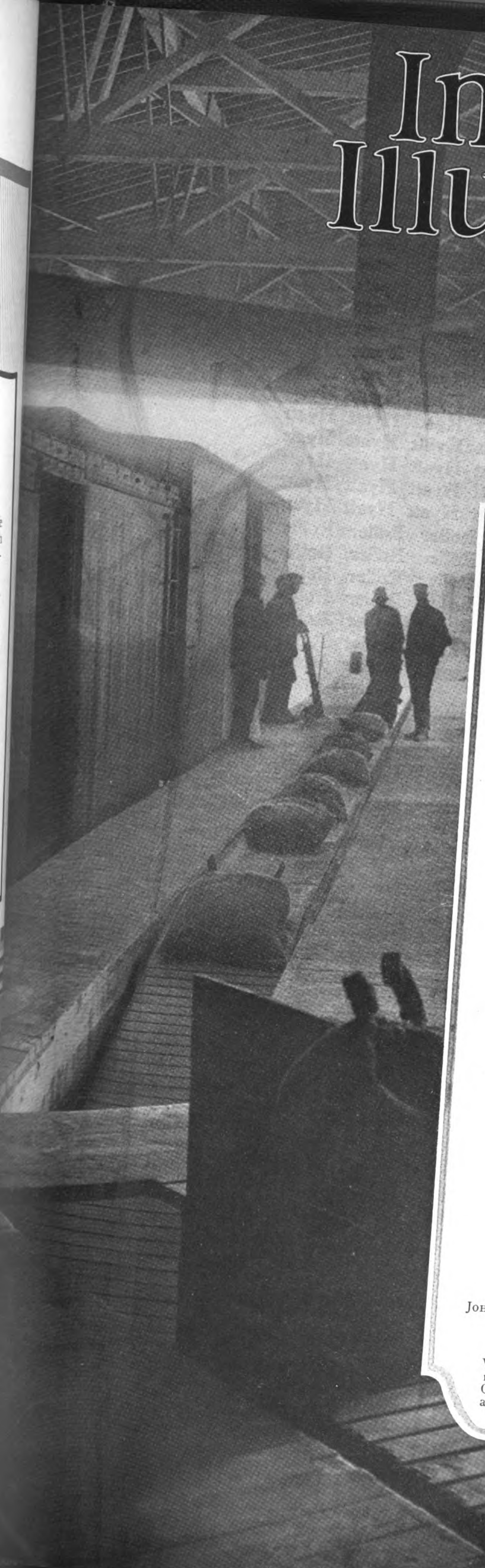
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Industry Illustrated



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Two wheel trucks, four wheel trucks, trailers, lift trucks—all become Better Trucks when equipped with Hyatt roller bearings.

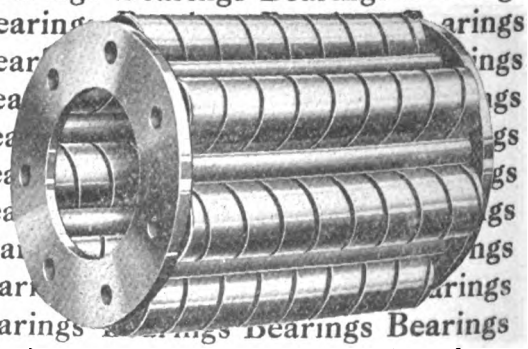
Better Trucks carry their loads easily, dependably and economically, their bearings — Hyatt roller bearings—last throughout the life of a truck without adjustment or replacement.

Better Trucks will cut your handling costs—specify Hyatt roller bearings and secure these economies.

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1.—A Barber-Greene is used for auxiliary storage near the boiler room, at the White Motor Co., Cleveland. By storing the coal in a series of parallel piles, maximum storage is gained in a small space.



2.—A Barber-Greene unloading castings at the Cleveland Tractor Company's plant.

3.—Loading trucks from storage with a Barber-Greene Coal Loader, in the yards of a large coal company.



A panicky market results when consumers' coal reserve falls to 20,000,000 tons.

20,000,000 tons

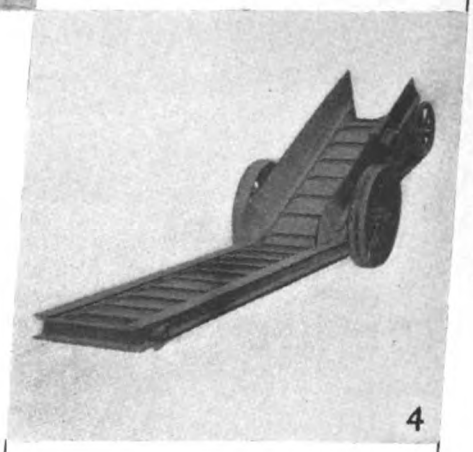
A 30,000,000 ton reserve still indicates a sellers' market.

30,000,000 tons

At 40,000,000 tons, salesmen go out after business on the consumers' terms.

40,000,000 tons

Send for our Coal-Handling booklet



4.—The Barber-Greene Coal Feeder, used for unloading cars. The horizontal extension rests on the rails so that no pit is necessary. Roller chain is used both on the drive and to carry the flights.

How Barber-Greenes are helping to maintain a buyers' market

"Consumers collectively have the power to make or break a market," says a recent report on coal storage. "The relation between the consumers' reserve and the price is almost mathematical. A reserve below 30,000,000 tons indicates a sellers' market; 20,000,000 tons indicates a panicky market; above 40,000,000 tons indicates a buyers' market."

Industrial consumers of coal find that advance storage is not only their soundest protection against plant shut-downs that too often accompany a coal shortage. It is also their one best means of maintaining a buyers' market.

And ample reserves are particularly advisable now. For they can be one of the strongest of all strike preventives this Spring when the present wage agreements expire.

But storage in any volume brings a difficult problem to many plants whose storage area is limited. If storing is done by hand, the area's capacity is soon reached. And it is a slow and costly method.

In cutting storage time and costs, and in multiplying the capacity of given ground areas, Barber-Greene methods have proved most successful.

Where four men could pile coal only 6 to 8 feet high, a Barber-Greene now stores it 16 feet high. At another plant a Barber-Greene increased the storage capacity of an area 600%, and reduced coal-handling costs from 68 cents to 12 cents a ton.

Our coal-handling booklet will throw interesting new lights on your own coal storage, reclaiming and handling problems. Send for it now.

Barber-Greene Company, 500 W. Park Ave., Aurora, Illinois

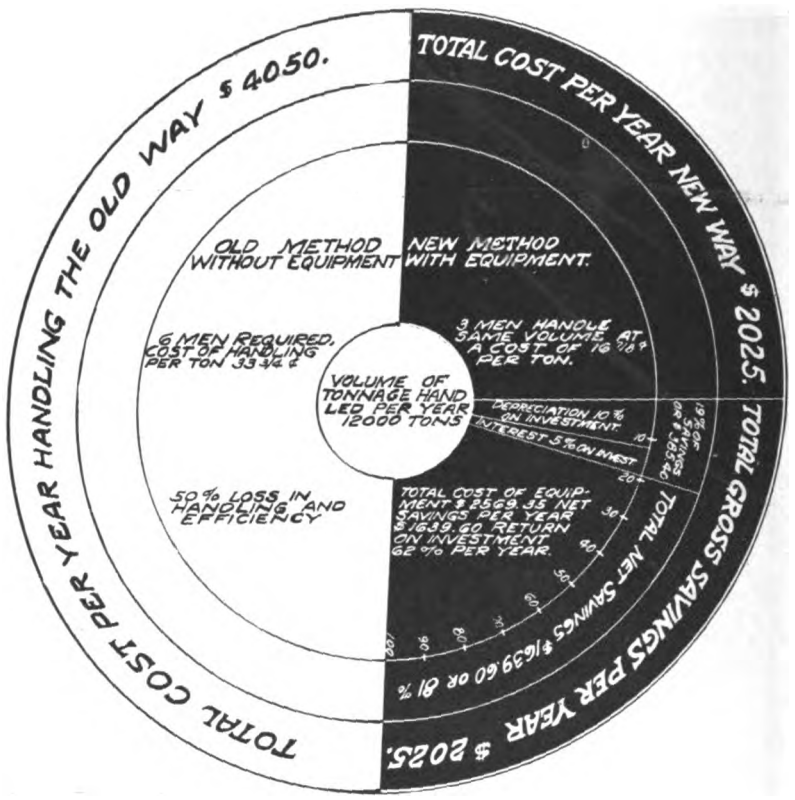
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Handling Costs Cut 50%

The Graph above brings out the fact that W. F. Hall Printing Company of Chicago, now pay 16⅞ cents per ton in the handling of their products instead of 33¾ cents per ton which was the old cost.

It shows that on 12000 tons of printed matter a year this company saves $2025.00.

That on an investment of $2569.35 this company realizes a return of 62% net each year.

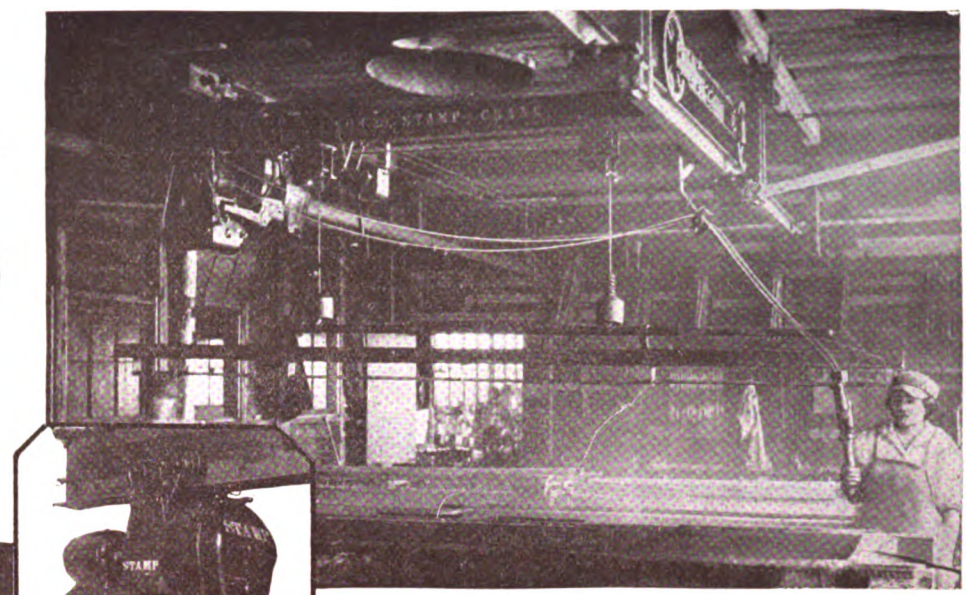
The equipment which brought about this saving consists mainly of a 6-story spiral chute connecting all floors with the shipping department and thereby speeds the handling and reduces the effort involved. Booklet S-2 showing this equipment will be sent on request.

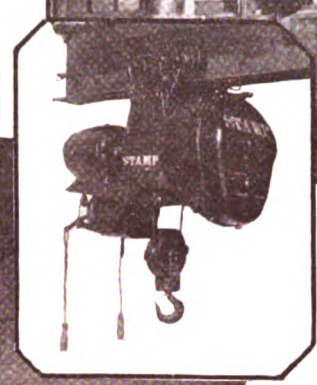
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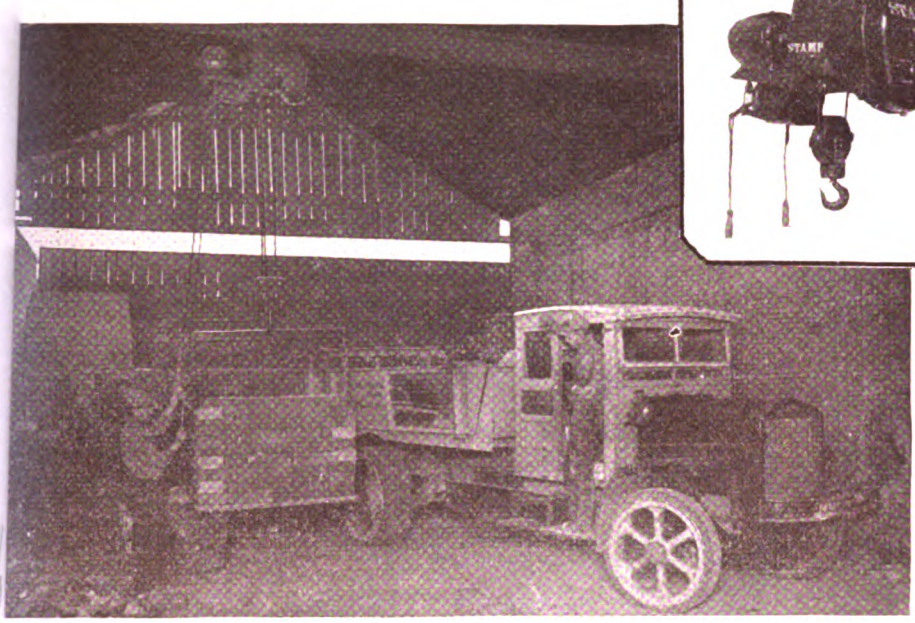
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In Dust—Grit—and Acid Fumes





This Hyatt equipped Stamp hoist, used by a chemical plant, to and from a dipping vat, is constantly enveloped in acid fumes.



A one-ton Stamp hoist manufactured by the Stamp Electric Hoist Company, Cleveland, Ohio, embodying seven Hyatt bearings.

A Stamp hoist, equipped with Hyatt roller bearings, handling loads of brick from kiln to truck. Continually covered with brick dust and grit.

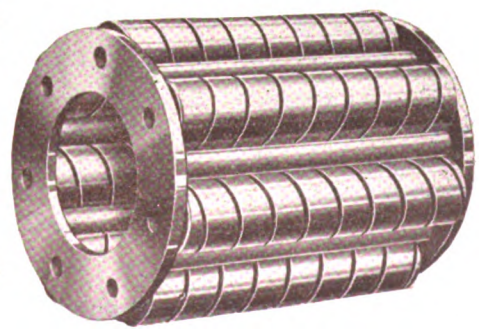
The efficient operation of Hyatt equipped cranes, trolleys and hoists is not hampered by the unfavorable conditions under which they work. These machines are fortified against any damage from the dirt and grit that settles on them.

The sturdy construction of Hyatt bearings enables them to withstand overloading and severe emergency duty. Even abuse and neglect at the hands of unskilled labor fail to cause any trouble. These bearings give smooth, uninterrupted service, year in and year out, without adjustment or replacement.

Even in the presence of acid fumes the efficient operation of Hyatt equipped handling machinery is not retarded. The distinctive features of the bearing housing and of the roller bearing itself insure complete and continuous lubrication. And it is only necessary to oil once every three or four months.

Hyatt equipped machines save operating power and labor, and speed up the work. The crane shown above as used in a chemical plant is operated through the entire working day by one girl, eliminating additional labor formerly required for the same work. The ease with which these machines may be moved and controlled makes them well adapted to use by girls.

Whatever the conditions under which your trolley, crane and hoist must operate, you will find that a Hyatt equipped installation will handle larger tonnage at lower costs.



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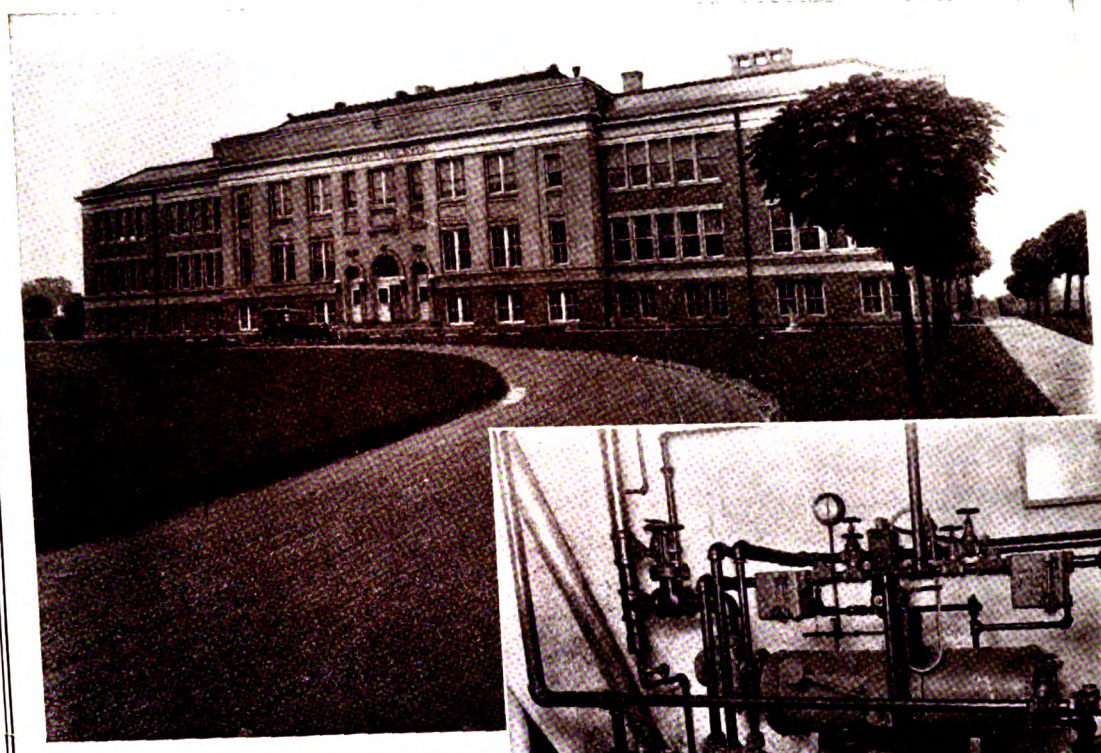
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Typical JENNINGS Installations

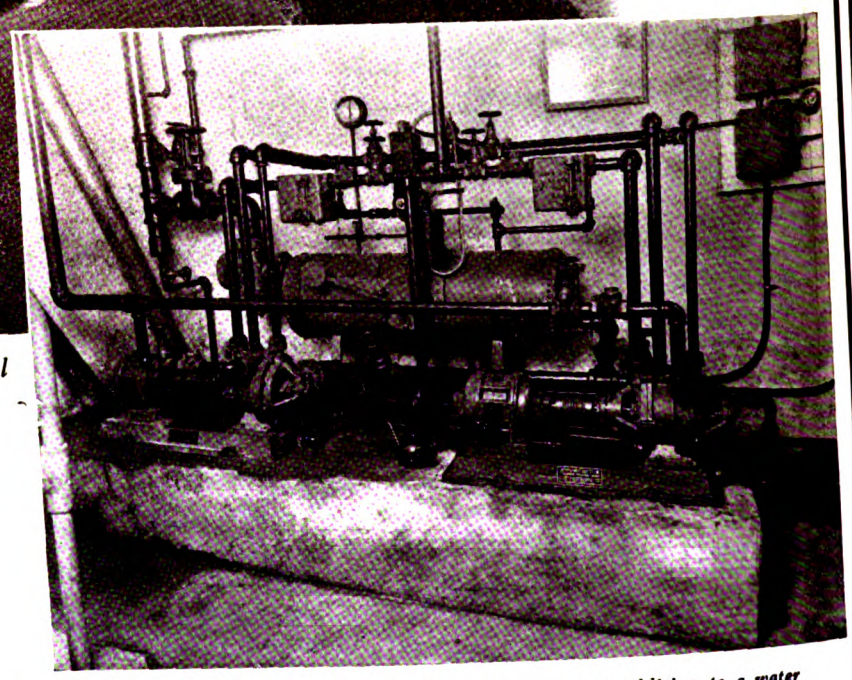
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Capacity each pump 40,000 sq. feet direct radiation, air capacity 25 cubic feet per minute in addition to a water capacity of 60 gallons per minute. The motors are only 3 horse power.

No matter how well designed a Return Line Heating system may be, its satisfactory operation is largely dependent upon the proper functioning of the Vacuum Return Line Pump. The Jennings pump has proven on thousands of installations that it possesses the features necessary for proper operation under the most extreme conditions.

Jennings Return Line pumps are simple in construction, containing but one moving element, running with a clearance in the casing. They are simple to install and operate, they require little floor space and are noiseless in operation. Their use results in a marked economy in coal. Many users hold that they more than pay for themselves in this respect alone. A Jennings pump on your system means quick heat in the most isolated radiators at a minimum steam pressure.

Now is the time to consider equipment for replacements and new installations for this season. Our Engineering Department is at all times ready to render service on problems relating to heating.

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EDITORIAL

Men and Materials

IN connection with the determination of the strength of materials for construction work, it is of primary importance that an engineer should know what is the elastic limit of each kind of material he uses. The elastic limit is "that load at which the deformations begin to increase at a higher rate than the applied stresses." In other words, it is the point at which a load becomes too great for a material to bear safely.

This elastic limit is different for each different kind of material. Some materials have extremely high elastic limits, such as steel; others have comparatively low elastic limits, such as wood. Two specimens of steel, or of wood, that appear to be identical, may show radically different values for elastic limit between the two steel specimens or between the two wood specimens, due to invisible differences in their molecular structure. It is evident then that the elastic limit for materials is a variable limit.

What would be the opinion of his brother engineers if an engineer disregarded the difference between the elastic limits of steel and of wood and used these materials interchangeably in building a structure; making one column, or brace, or girder, of steel and making the next, that is intended to carry the same load, of wood? The very least they would say of him would be that he is no engineer and, without doubt, their private opinion would be that he had become crazy. They would know that no material structure built in such a manner could fulfill the purpose for which it was intended.

How strange it is, therefore, that so little attention is paid in industrial affairs to the elastic limit in its *human* application and that so few attempts are made to differentiate between men who have low elastic limits and those who have high elastic limits.

There is a great difference, however, between materials and men. The materials having high elastic limits are most valuable for constructive purposes, but those men who have *low* elastic limits are the most valuable to industry. A high-strung, sensitive, temperamental man, possessing a high degree of mentality or intelligence, has a very low elastic limit; but a phlegmatic, stolid man, possessing a comparatively low degree of mentality but much greater physical strength, has a very high elastic limit. The former can only withstand carefully considered loads carefully applied; the latter can withstand heavier loads less considerately applied.

Why, then, does industry so often load each of these equally with the same kind of work and expect as much of one as of the other, applying the same value for elastic limit to both? Each type has his place and each of them is a good workman, but men—no less than materials—must be differentiated on the basis of the value of their respective elastic limits. Only so, can Industry progress.

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Planning the New Factory Building

By Walter F. Ballinger

President, The Ballinger Company, Architects and Engineers

SOME factories just grow, and grow so fast that many inefficiencies in layout and operation creep in, which, though recognized and regretted, are allowed to continue because their correction would take time and effort that could be more profitably expended elsewhere.

When a plant is making money, and is growing so rapidly as to absorb all of the executive's time and spare capital trying to keep up with a profitable and increasing demand, who would say it were better to stop, reorganize, and reconstruct, in order to conform to accepted standards of efficiency? Efficiency experts must increase profits, not retard them.

But when circumstances require the relocation, rearrangement, or consolidation of existing plants, and when new plants are organized no one will question the value of thoroughly planning the new unit to incorporate every possible means of increased productive capacity and decreasing production costs.

Planning the new factory to attain the owner's Utopian dream of maximum production at minimum cost is not a complex process in itself, but it requires an analysis of many complex factors, and a nice judgment in balancing the advantages and disadvantages of each element entering into the problem. Many schemes are offered that will increase production enormously, at the same time increasing manufacturing costs. Many means will suggest themselves for cutting down the cost of the plant at the expense of productive capacity. The real job is to select those arrangements, materials, and methods that function to increase production without increasing the cost, or to decrease the cost without sacrificing output.

The first step is to gather facts. It is facts, not guesses or deep-rooted opinions we need. Many plants are laid out incorrectly because the owners have assumed a knowledge of facts when they have simply held opinions. Facts are hard to gather, especially if the collector be thoroughly familiar with existing conditions. An outsider can see many important facts that the owner sees, but does not duly appreciate. Have you ever



Fig. 1. Space requirements and building types are affected by the nature of the process. Automatic machinery, for example, secures high production per unit of floor space.



Fig. 2. Where hand work is required and particularly on products such as the above, production per unit of floor space is necessarily low and suitable physical arrangements must be provided.

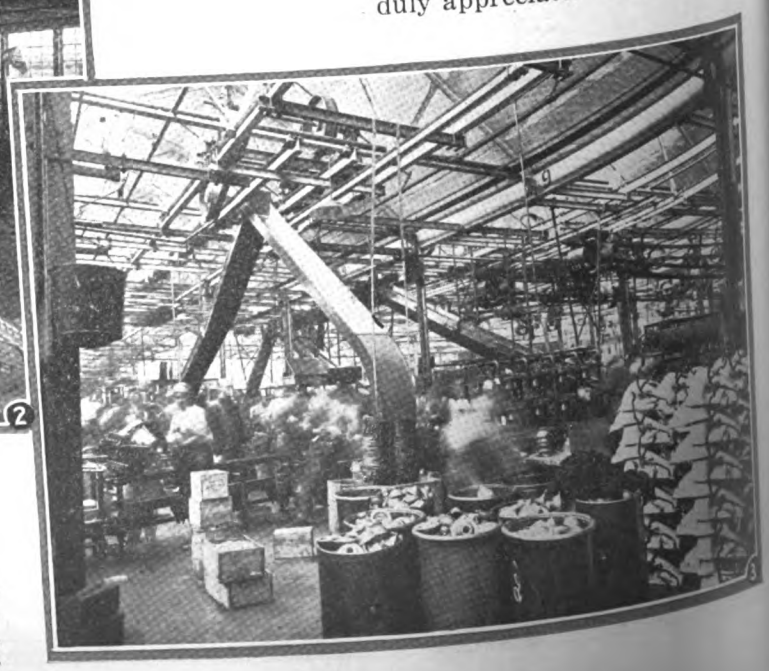


Fig. 3. Work must be brought to and taken away from machines. An estimate is required of the space necessary for aisles, trucks, cans, baskets and other containers.

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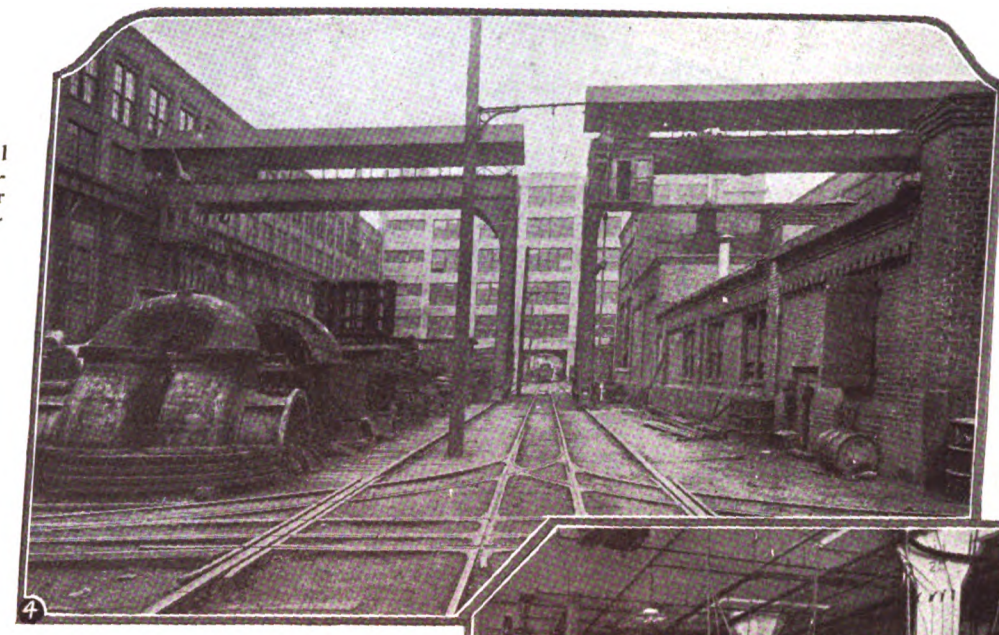


Fig. 4. Storage of materials in all stages of completion must be carefully studied and provided for either outside or inside of the building.

taken a sight-seeing bus in your own town, and realized how many things, commonplace to you, are pointed out to visitors as places of special importance and interest? The principle is the same.

To gather facts, we should work from the general to the particular. An analysis of the market for the product should be made, showing the present demand and the probable future demand for your goods. Then you should establish what proportion of the total demand you intend to supply, both in the immediate future, and, if possible, a decade or so hence. This will give you a basis for estimating your production capacity, and will indicate the probable rate of plant expansion to be provided for. Admittedly, this first step calls for rare judgment and business foresight, but it is of fundamental importance.

Having established your output (per day, week, or month), the product itself is analyzed into its component parts. If your product is lead pencils, there are the two halves of the wood-shaft, the graphite core, the metal ferule, and the rubber tip. The quantities needed of each different part being established, the machines required to produce each part are considered. Some parts will be produced by automatic machinery



Fig. 5. While the contributing departments may be independent, the product parts must come together for assembly. This must be considered in the original plant layout.

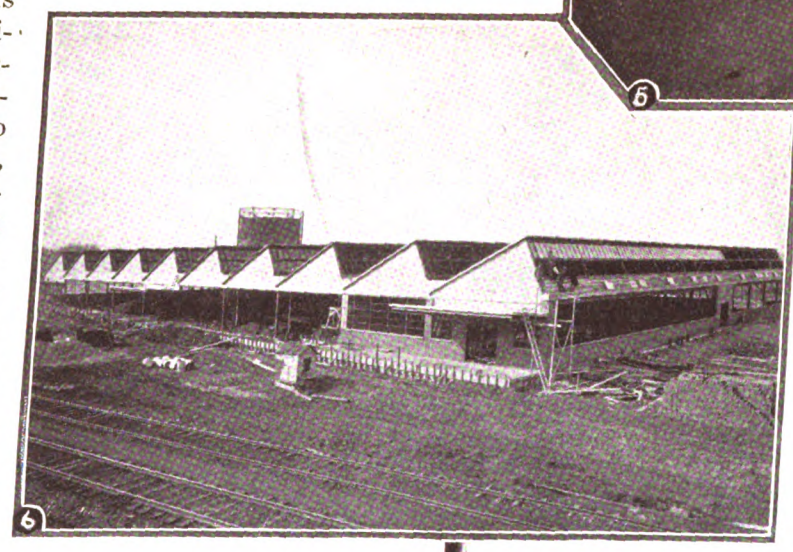
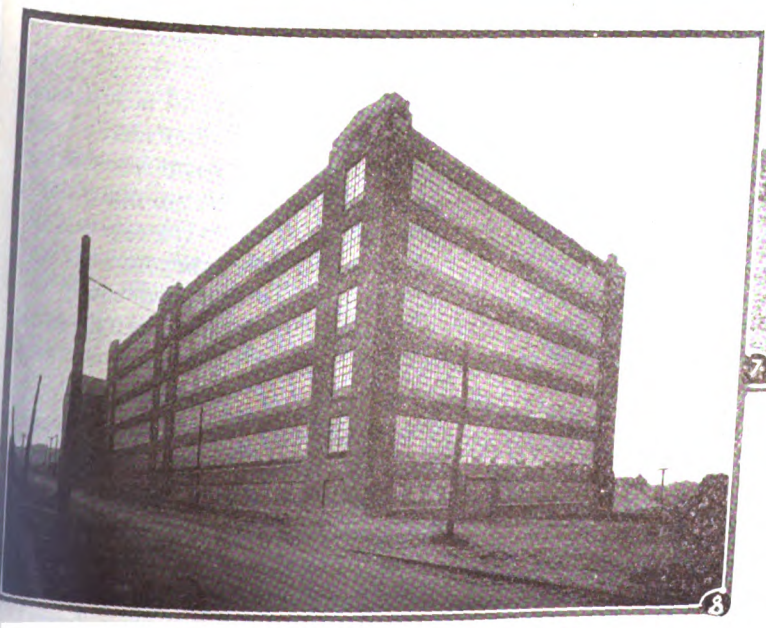


Fig. 6. Where land values are low the choice of a one-story as compared with a multi-story building must be made with care.



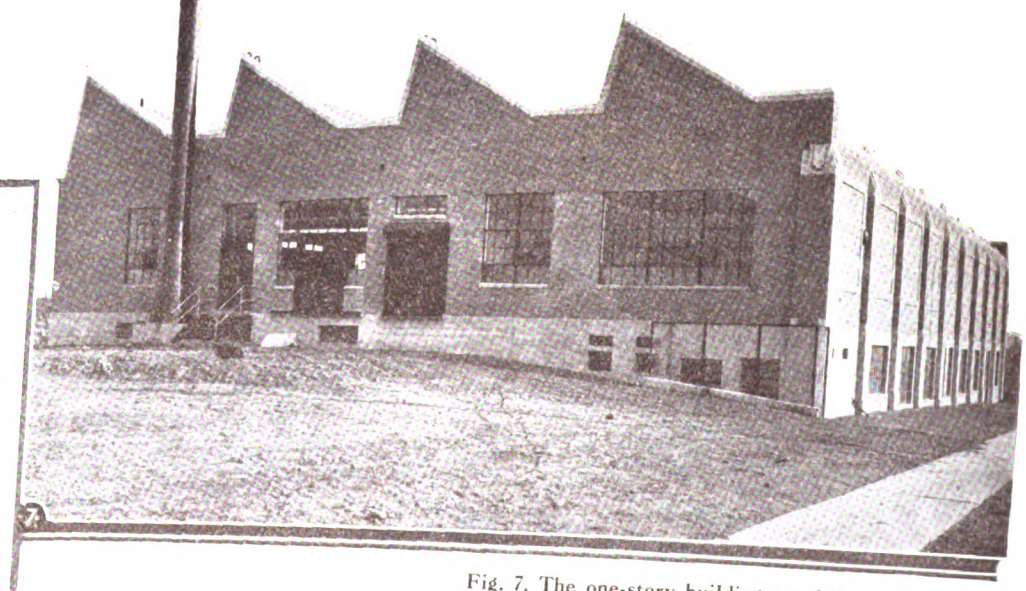


Fig. 7. The one-story building requires more roof and foundation wall but under some circumstances may actually cost less per productive square foot of floor space.

Fig. 8. Land value is not the only consideration in the choice of a multi-story building. The nature of the process may dictate this type of construction.

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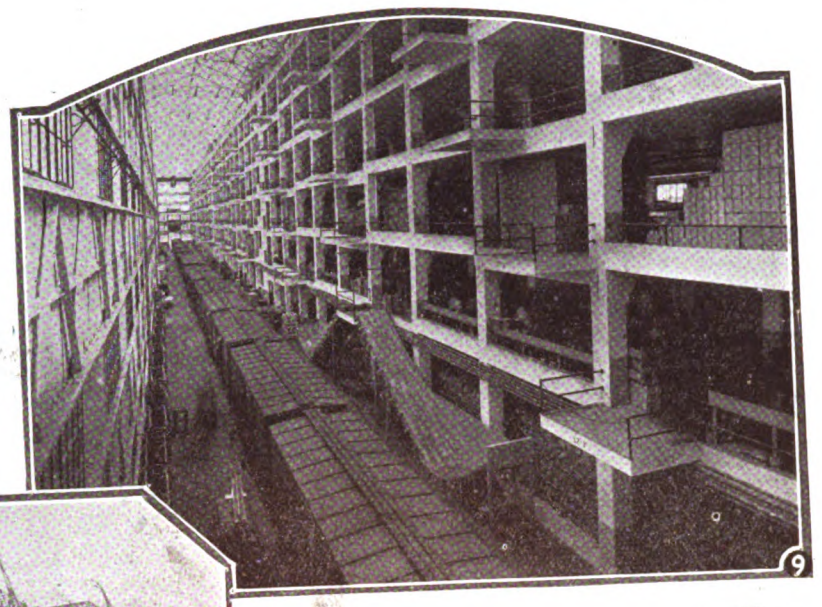


Fig. 9. The various floors of a multi-story building may be compactly knit together for transportation and shipping purposes through modern design and construction.



Fig. 10. The modern industrial plant can be erected with amazing rapidity once its plans have been determined. But careful planning in advance is essential to highest output.

at high speed, and very few machine units will be needed. Other parts will require processing through many different machines and possibly will require hand-work of many operatives. A complete schedule should be made showing the number of each kind of machine necessary to produce the parts, which, when assembled, will comprise the required output of your finished product. If your product is diversified, the same analysis must be made for each article.

All this sounds elementary, perhaps, but often it is well to check over each step in a development, to make sure that no points are overlooked.

With the schedule of machines in hand, templates are cut out of cardboard to some convenient scale, showing the floor space required for each unit. The templates are tentatively laid out on a hypothetical floor plan and

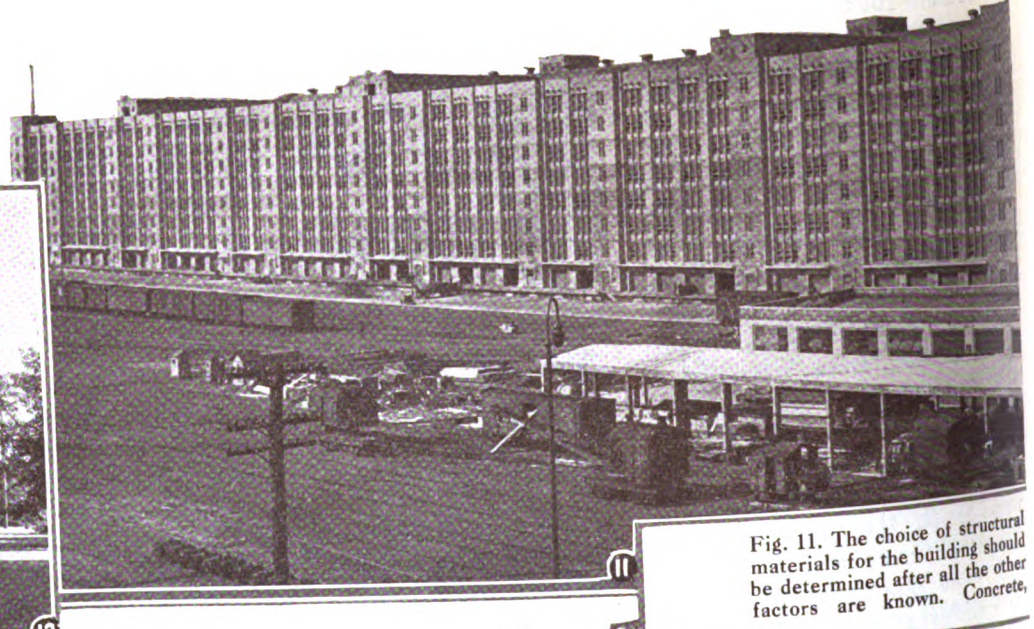


Fig. 11. The choice of structural materials for the building should be determined after all the other factors are known. Concrete,



Fig. 12. Planning the grounds for beauty and convenience is an integral part of modern plant layout and has its distinct effect upon production.

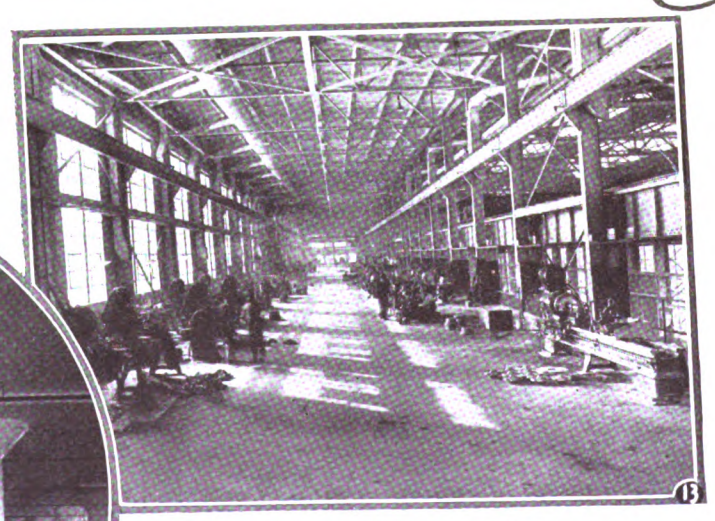


Fig. 13. Unprotected steel framing may be safely used in some structures but in others would entail a great loss in the event of fire.

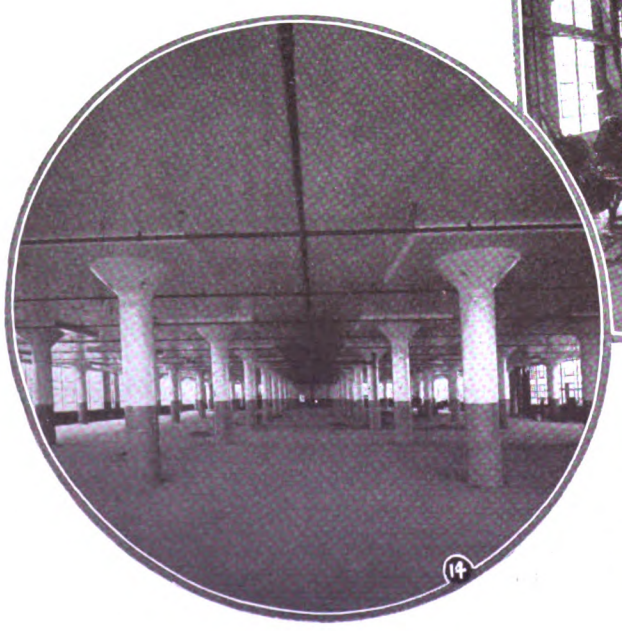


Fig. 14. Columns are planned in such manner as to interfere least with the machines on all floors, also to provide flexibility as far as possible in future and different uses of the building.

are spaced to allow room for the operatives, and for the materials (both unfinished and finished) that are associated with each machine. A decision should be reached regarding the need for space to repair and adjust each machine. The older method was to allow ample room for working around each unit; in many modern plants no extra space is allowed for such purposes, the machine being removed bodily for repairs, or else the repair work is done when the plant is closed at night or on week-ends.

While this arranging process is going on, many other factors must be taken into consideration. Work must be brought to and taken away from the machines, requiring aisles and space for trucks, cans, baskets,

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ner containers and han-quipment. To arrive at ace needed for each of ems, an estimate must be f the amount of material space at any time, and k it occupies.

us go back to our produc-hedule. After analyzing evelop the number of ma- required for each part, ould also arrive at the t of raw material needed et the established output. ubject should be pursued we have found out the ities, weights, and volume h kind of raw stock needed kept on hand at any given Sometimes this means go-r outside of your own plant ermine what deliveries you ely upon from sources be-your control.

th these data at hand, we d set about establishing a e r i a l storage and flow

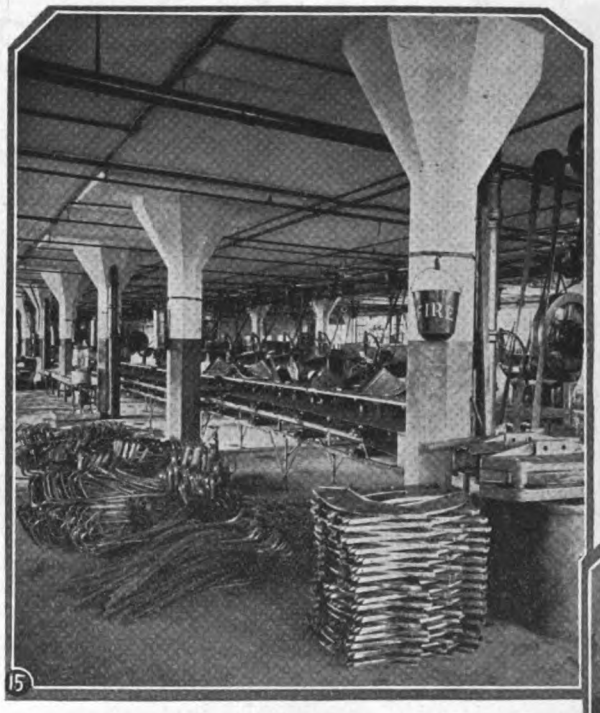
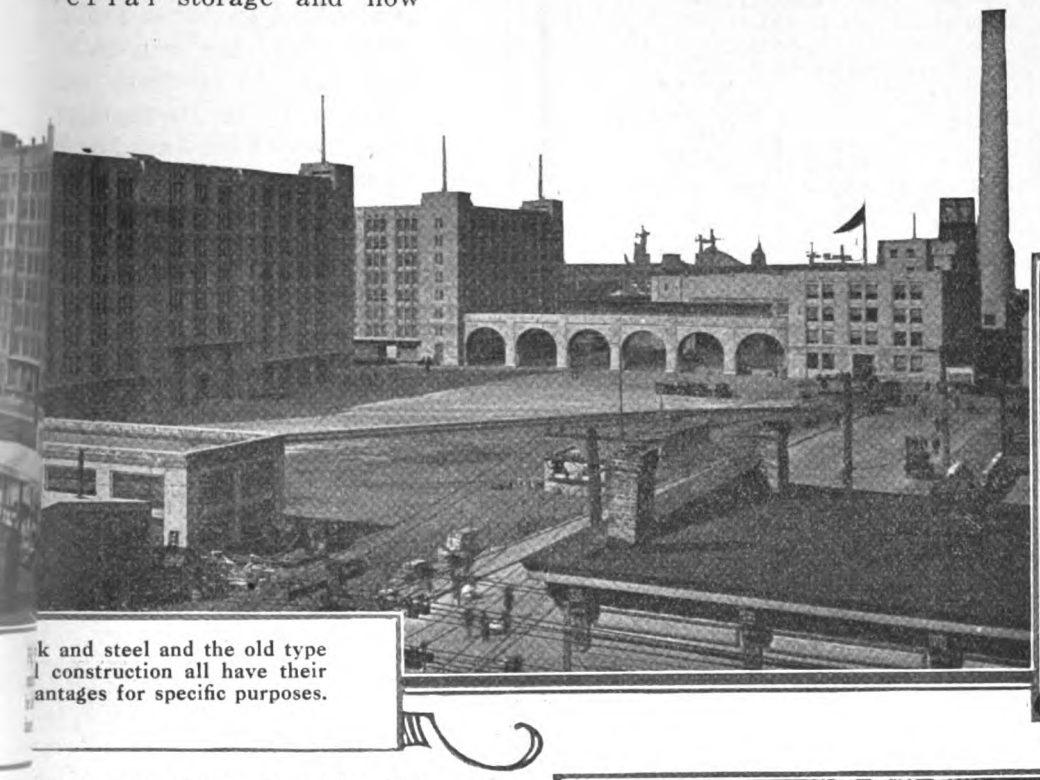


Fig. 15. Proper space must be allowed for conveying equipment, work in process, and for the operators in arranging for column spacing and location.



Fig. 16. Toilet and wash rooms, like stair towers, elevators and fire escapes, must be located in positions which best meet requirements.



k and steel and the old type l construction all have their antages for specific purposes.

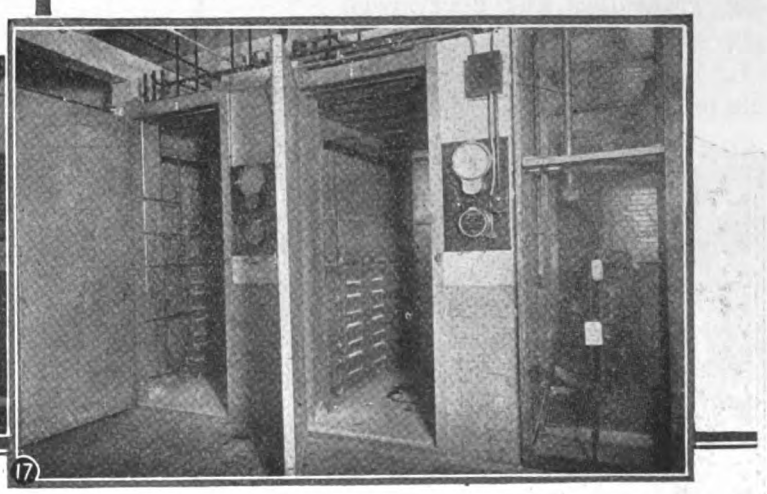


Fig. 17. Electrical feeders and the distribution system govern the location of switchboards, conduits and distributing panels, and must be carefully planned in advance.

neme covering not only the ace required to take care of e stock at each stage in the ocess of manufacture, but also e method of handling it from e store rooms, through the ant to the shipping platform.

We now have in hand the rincipal space requirements for ur building, for we know the pace needed for the machines nd their operatives, for mate-ial in storage and in process, nd for traffic through the plant oth in vehicles and in con-eyors.

This work will already have uggested certain desirable re-ationships between machines nd processes. We will find lines of demarcation between certain parts of the work where the rela-

(*Continued on page* 71)

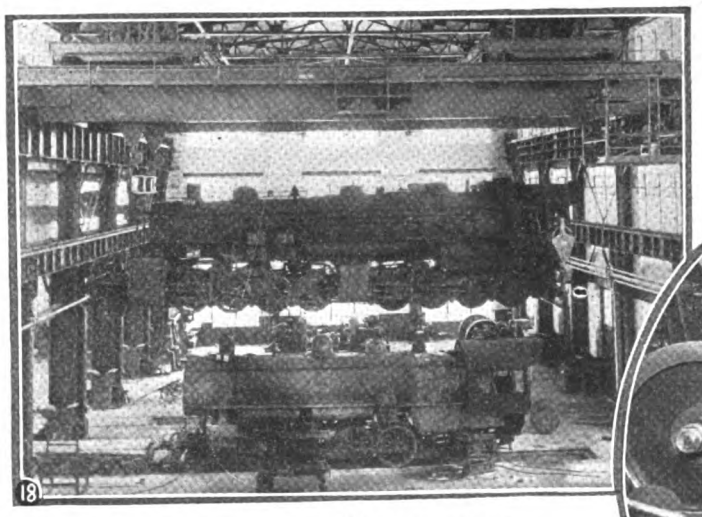


Fig. 18. Overhead travelling cranes have a decided bearing upon the type and size of structural steel work required for their support, in addition to ordinary structural requirements.

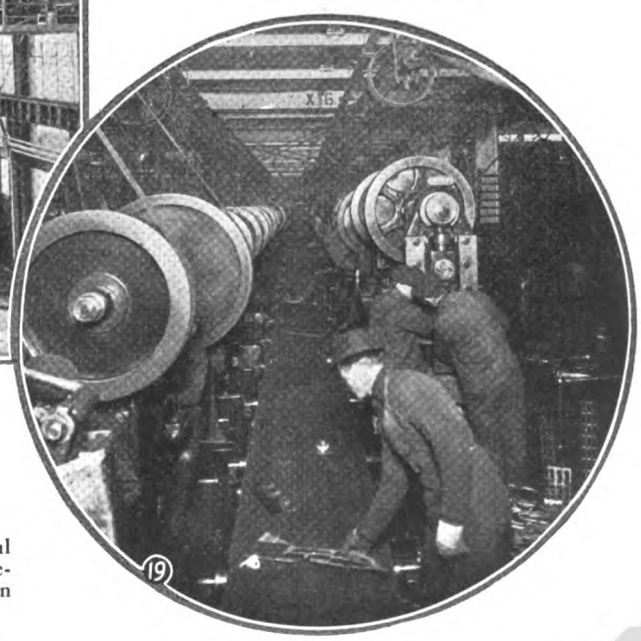


Fig. 19. The modern system of mechanical handling has revolutionized machine placing and spacing, and is a prime factor in building planning and layout.

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Health, Production, and the Plant Plumber

By William G. Ziegler

THE work of the Pipefitters, Plumbers and Tinsmiths has a very important influence on the health of all the workers in the plant from the manager down to the least important worker, for if the plant is improperly heated and ventilated and has unsanitary plumbing, the chances are that many men will be home sick for days at a time when they should be producing. This is an economic loss which will not be continued long if one would investigate how much this neglect is costing every year. If the plant is underheated, the men will waste one or two hours in the morning making themselves warm, and even if they are doing piece work, they are not getting out the capacity of the machine on which they are working. Machines and floor space cost money whether they are being utilized to capacity or not. Improperly ventilated rooms are also hindrances in the performance of the work, making the workers "logy" or sleepy and thereby preventing their doing the best in them. Probably the most insidious cause of disease is unsanitary plumbing and it should not be tolerated. Up-to-date plumbing fixtures properly installed are a paying investment, and if they are kept clean, all danger from this source will be eliminated.

In the maintenance work on piping in old plants or in plants where changes or additions have been made from time to time, it will often be found that the piping is not properly laid out, but goes in a roundabout course. In this case, it is well to rip it out and straighten the runs, if economical results are to be expected. In this article we will consider only the maintenance of the piping in the plant proper, that is, all piping outside of the power plant. A great deal of damage is done each year by leaks in piping and fittings and this loss can be largely obviated by proper maintenance.

Overheating is not to be recommended, because it is not good for the men. The correct temperature for any class of work should be carefully studied and that temperature should be maintained. It has been found, from years of experience, that a temperature of 68° F. is correct for work-rooms, such as assembling rooms and machine shops where the men do only a small amount of heavy manual labor. However, in foundries or other places where hard or heavy labor is performed, the temperature should be between 55° F. and 68° F. depending on the work.

In connection with overheating, it has been found that in light assembling rooms where the normal temperature should be 68° F. that an increase to 75° F. caused a loss in production of fifteen per cent. At normal working temperatures the degree of humidity should be between fifty to seventy per cent.

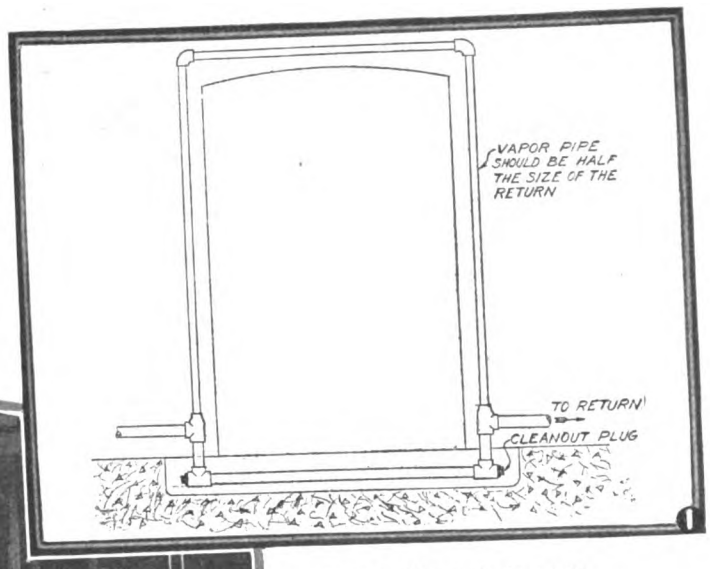


Fig. 1. Where it is necessary to run a heating pipe return line under the floor at a doorway, the sketch shows a method which has been found most practical.

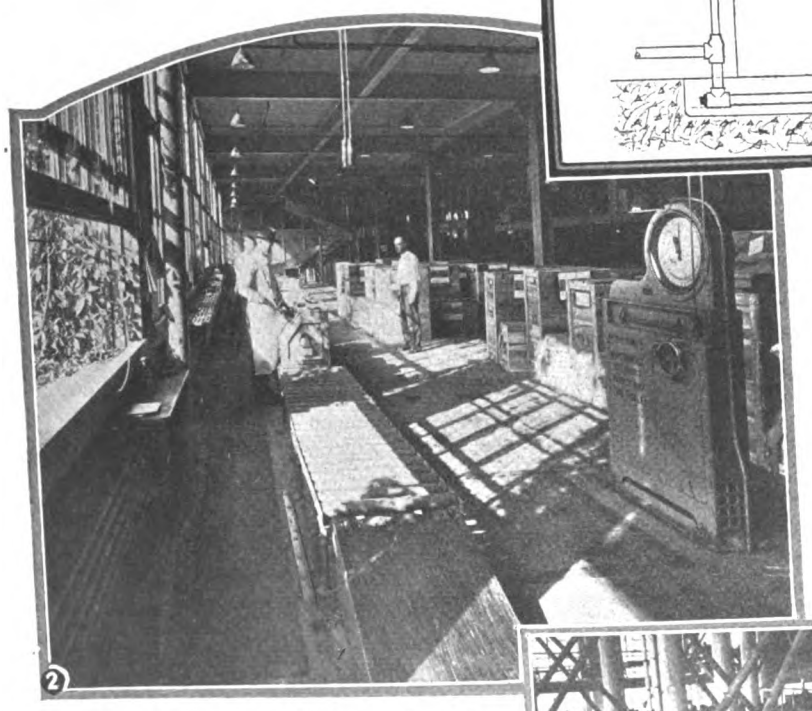


Fig. 2. Note the location of heating pipes below the windows. These pipes should be so supported as to allow for expansion.



Fig. 3. In buildings with high ceilings, the purity of the air is not much affected by recirculating it; which simplifies the heating problem materially.

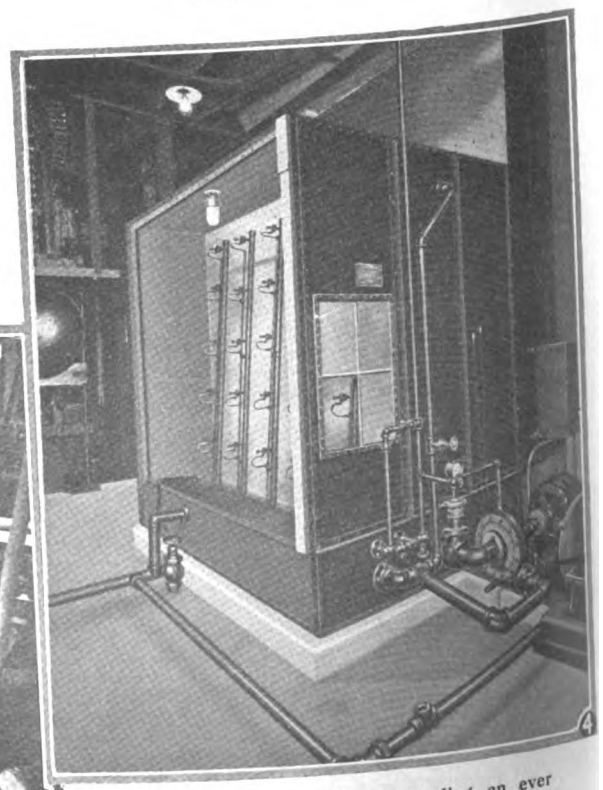


Fig. 4. Air washers are finding an ever wider application in industry, and the health of both men and delicate machines depends upon their proper functioning.

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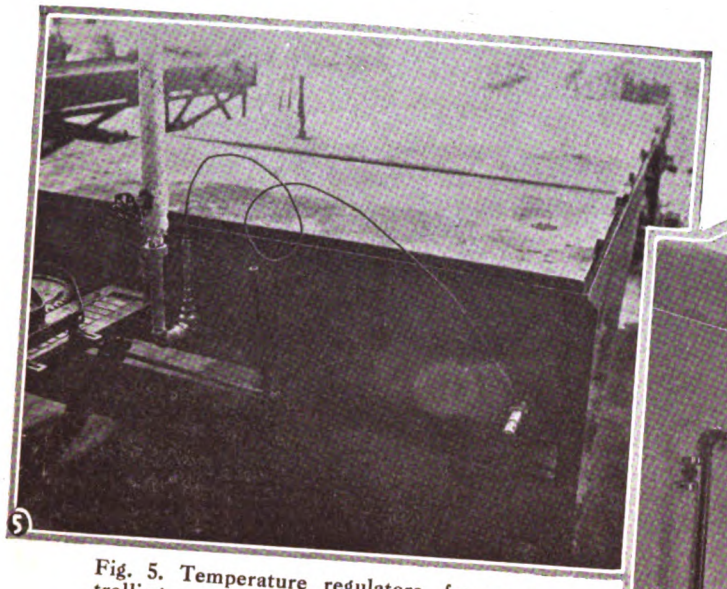


Fig. 5. Temperature regulators, for controlling temperatures in process tanks, ovens, etc., are a source of saving in heat that must not be overlooked.

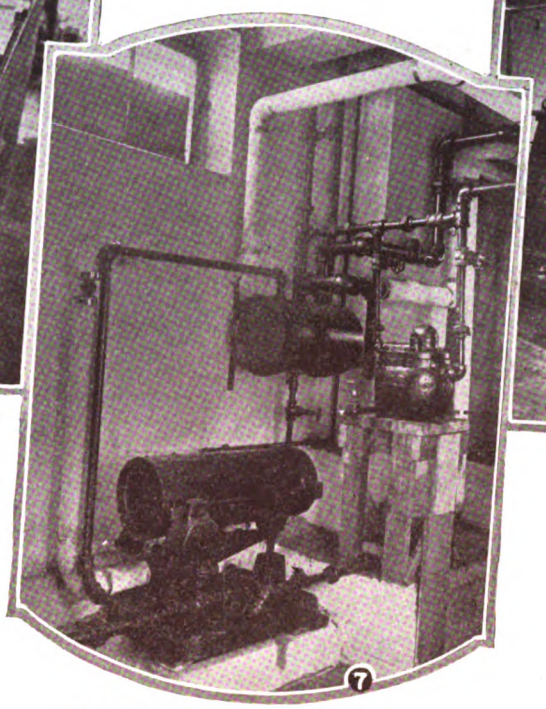


Fig. 7. A great deal of steam is wasted by failure to use the proper kind of steam trap—and, in some cases, failure to use any trap at all.

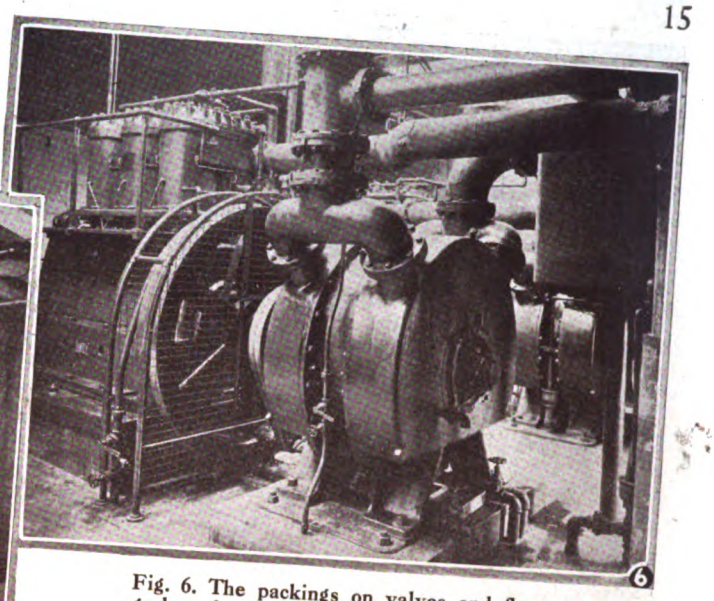


Fig. 6. The packings on valves and flange gaskets have a habit of drying up. Such packings should be renewed before they have a chance to allow leakage.

This is a very important point to be considered in connection with heating, as in nine cases out of ten, the air in industrial plants is too dry during the winter season. This subject will be considered more in detail later in this article.

Most industrial plants are heated by so-called direct radiation, that is steam or hot water radiators or pipe coils. There are three systems commonly used: (1) The two-pipe system for steam heating, having an open or gravity return line; (2) The vacuum system of steam heating, and (3) The hot water heating system. In the first mentioned open or gravity return line system, the pressure in the piping and radiators is a little above atmospheric pressure. The condensation flows by gravity to a tank or sump, which is vented, and from there returned to the boiler. During mild weather the boiler pressure need only be a little above atmospheric pressure and in very cold weather the pressure may be raised up to about ten pounds at which point the safety valve will blow off.

In the second mentioned, or vacuum system of steam heating, the pressure in the supply piping and radiators is maintained either at atmospheric pressure or slightly above or below it and the pressure in the return piping is maintained at less than atmospheric pressure by the vacuum apparatus. These two systems are similar, the difference being the method of taking care of condensation and air along with it.

In the third or hot water heating system as used in plants of any size, the water is heated in a closed heater and circulated by means of a pump. As this system requires more radiation surface than either of the steam systems, it is not largely used in plants. Another point to be considered is that it requires a large closed heater and a pump, usually a turbine driven centrifugal.

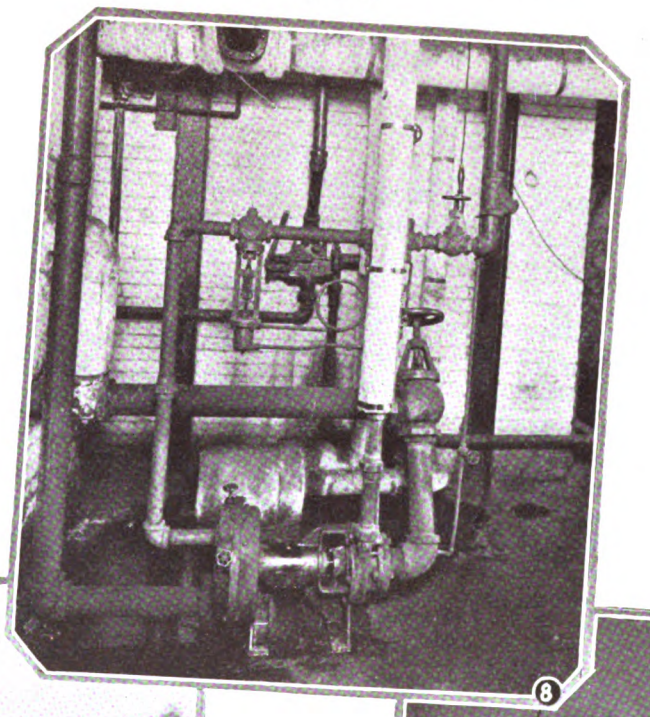


Fig. 8. From the standpoint of economical maintenance, the savings which can be effected by the judicious use of pipe covering, are everywhere apparent.

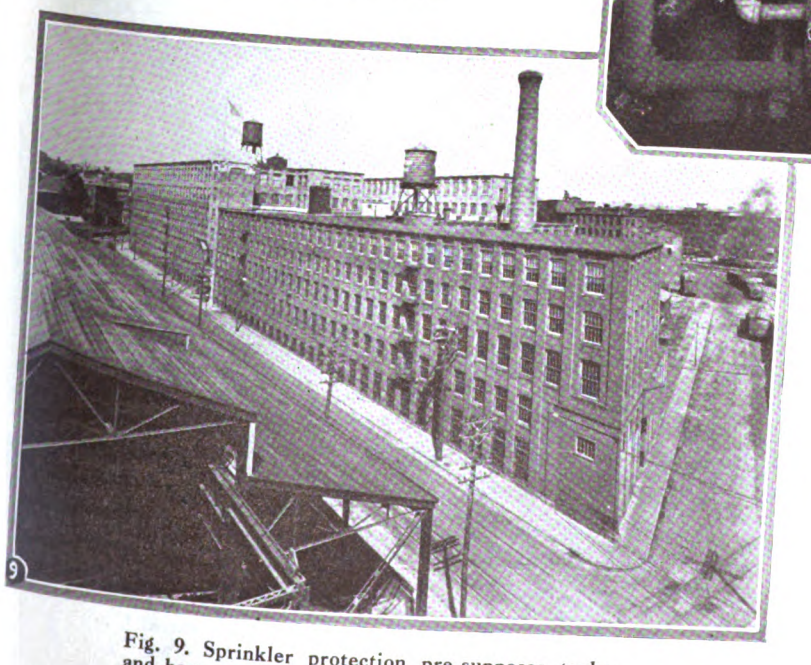


Fig. 9. Sprinkler protection pre-supposes tanks—and here provision must be made to guard against leakage and against the possibility of freezing.

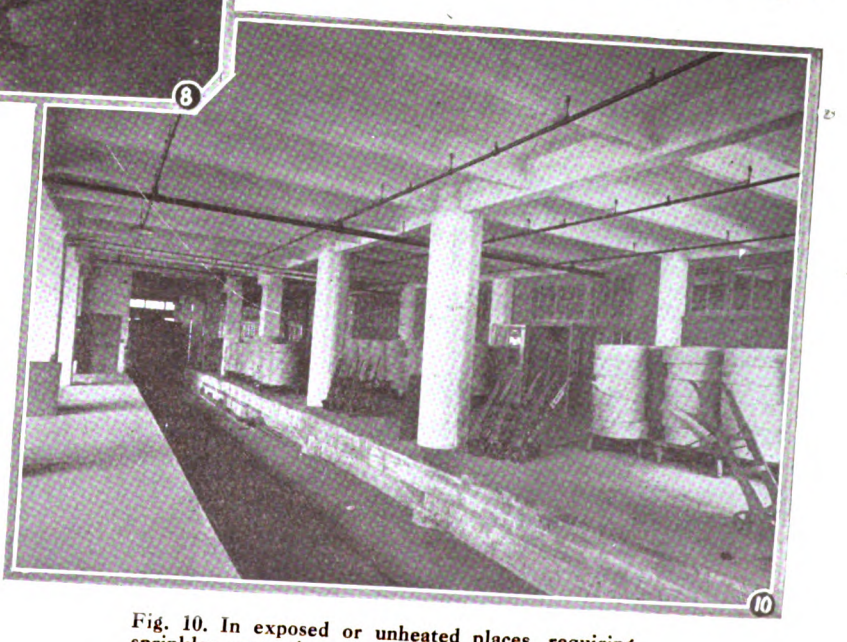


Fig. 10. In exposed or unheated places, requiring sprinkler protection, the "dry pipe system" is the obvious solution; doing away with the possibility of frozen pipes.

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Fig. 11. Valves on sprinkler lines should be sealed, and it is a good plan to have enamelled signs at each valve, listing the rooms it controls.

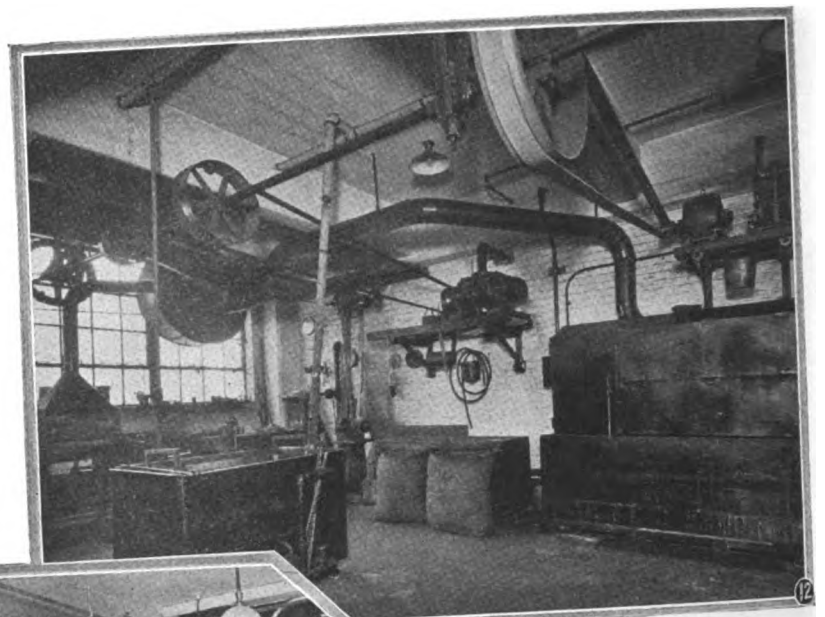


Fig. 12. Steam for process work, tanks, etc., should be on separate lines from the heating system, so that only these separate lines need be open in summer.

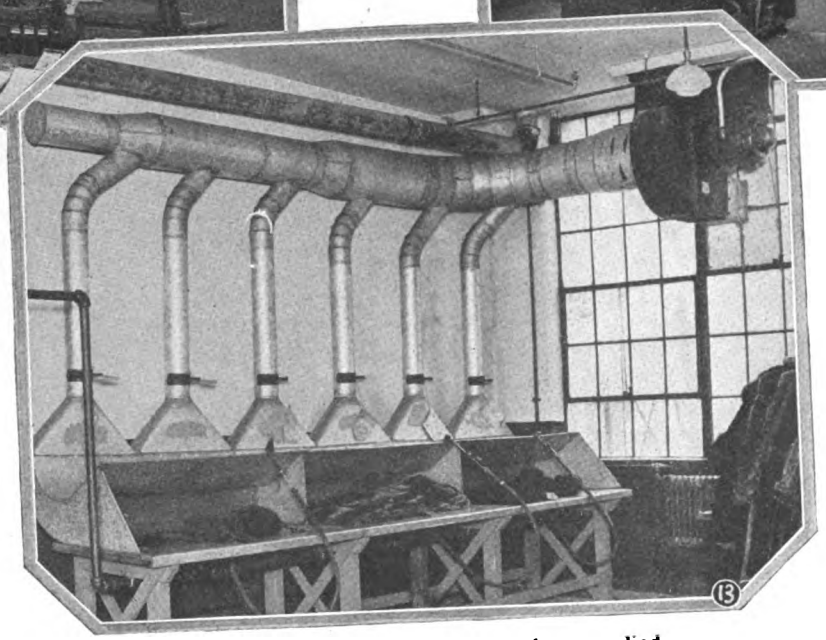


Fig. 13. The same idea which has been applied to drawing out poisonous fumes and dust is used to an increasing extent for carrying away dirt and keeping the air free from contamination.

The whole subject of heating is one which can be scientifically treated, the structural details such as window areas playing as important a part in the correct design of a heating system as the cubic contents of the building. With coal prices at their present level and with wages about double what they were ten years ago, any losses that can be cut down due to poorly designed piping, should be carefully investigated. In order to meet competition all costly wastes that have been allowed to go on, must be stopped and every unit made to function at a minimum cost.

In order to take care of expansion in steam pipes, bends should be used, or else expansion joints should be installed. Where there is space for them, bends are preferred as there is nothing to get out of order if the bends are properly designed. In cramped quarters, expansion joints are used, but they should be provided with an anchor base, so that they can be securely fastened. In the average plant, pipe coils are used for radiation. In order to provide for expansion and contraction, a mitre piece should be put on the end nearest the supply. This mitre should be about one-tenth of the length of the coil itself. Coils should not be longer than sixty feet in order to obtain the best results. They should be anchored at the return header, so that the expansion will be at the mitre at the other end.

The question of correct design and size of distributing pipes has a great deal to do with the even distribution of heat throughout the plant. If pipe sizes are not correct on the branches from the mains, the coils nearest the boiler will receive all the heat. It is possible to throttle valves or put in smaller pipes leading from the mains to the coils nearest the boiler, but in old systems which are not efficient, it is best to call in a heating engineer who will guarantee to make the system function properly. One system now on the market makes use of orifices inserted into each feeder where it leaves the main. However, all the well-equipped heating engineers strive to accomplish the same result, namely, even distribution of heat at a lower cost.

In buildings with high ceilings, such as erecting shops, foundries, etc., the unit system

(Continued on page 61)



Fig. 14. In this plant, not only is ventilation accomplished by forced draught, but in the foreground is a pipe used for conveying cotton to the mill by means of moving air. Obviously, the maintenance department must function properly here!

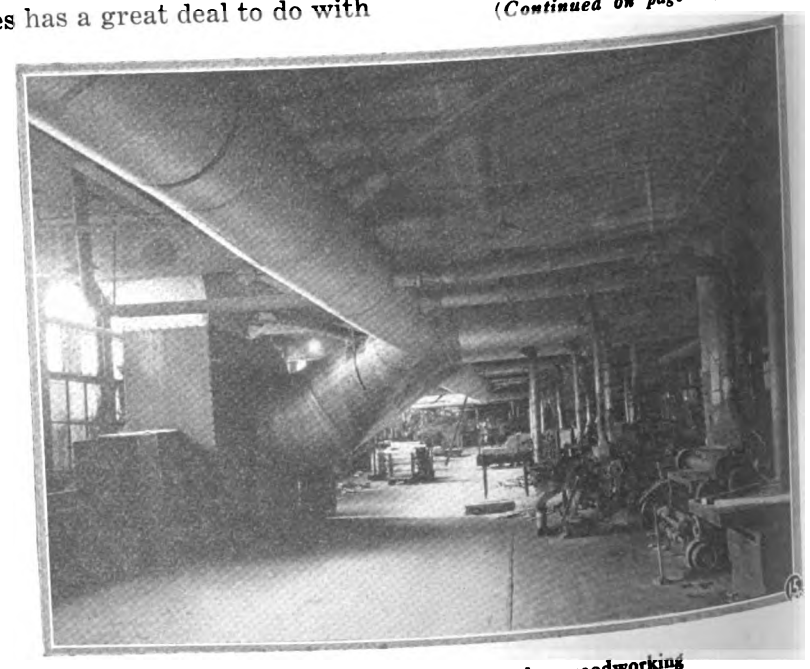


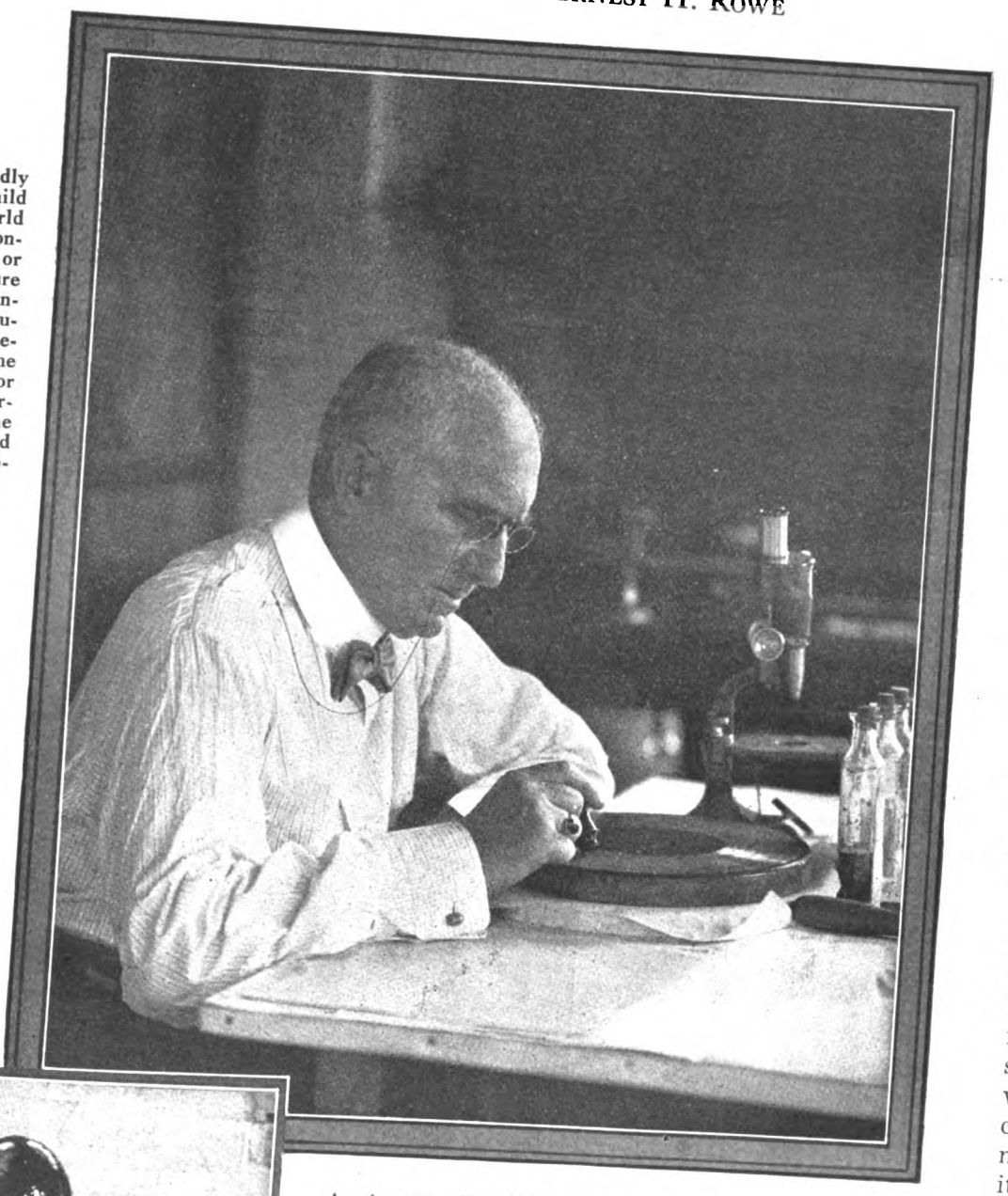
Fig. 15. The exhaust system of a woodworking department must be kept in proper shape. Not only is its work exacting, but, in most states, such installations are required by law and are held to rigid regulations.

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Freeing the Human Voice From Its Inherent Limitations

Emile Berliner, Inventor of the Telephone Transmitter, which Projects the Human Voice Indefinitely; and of the Gramophone, which Immortalizes It

By Ernest H. Rowe

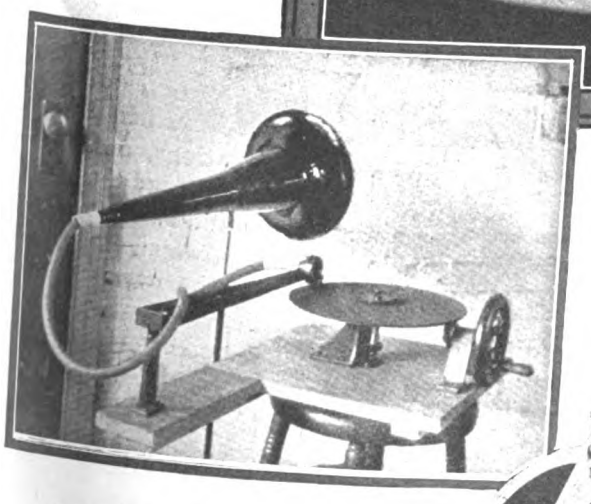


Emile Berliner. Hardly a man, woman or child in the civilized world but owes pleasure, convenience, health or safety in some measure to this server of mankind, through the instrumentality of the telephone transmitter, the disc talking machine, or the now almost universal understanding of the dangers of raw milk and of simple hygienic habits.

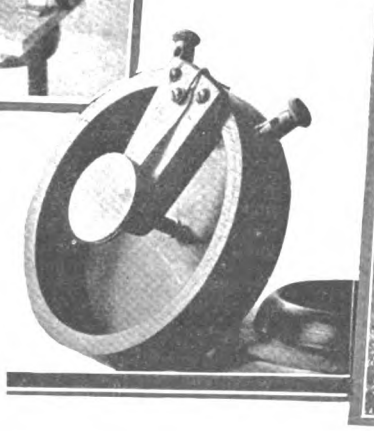
THERE are some pictures to go with this story, but you can illustrate it better yourself. The objects themselves, better than mere pictures, are probably in sight as you read this if you are in your living room or library. To get the right atmosphere, before you settle down to reading in your morris chair, set your telephone on one side and start the Victrola going with "Yankee Doodle" or the Declaration of Independence for just the right local color. Then set up before you the picture on this page, the portrait of the man who is responsible for the telephone transmitter and the disc talking machine, Emile Berliner, of Washington, D. C. One thing more—go to the ice box and bring out a bottle of pasteurized milk. It is a vital detail of our scenery. If you can add a healthy, hungry baby pulling on the bottle, all the better.

What has a telephone transmitter or a gramophone to do with bottle babies? Nothing. But Emile Berliner has had much to do with all three, besides other things without which our twentieth century civilization would not differ so much from previous centuries as it does. I sometimes stand on the Battery sea-wall when the ferry comes over from Ellis Island and I see other spectators grin and hear them sneer or joke about the "wops" or "heines" or "squareheads" as

(*Continued on page* 50)



At the left—The gramophone as the Franklin Institute first saw it in 1888, employing two new and distinct ideas in sound reproduction—the disc record and the swinging arm to carry the reproducing stylus so it may follow the spiral record groove, being both vibrated and propelled thereby.



At the right—The telephone transmitter when, through Berliner's discovery of the loose contact principle, and his use of the induction coil, it first became a simple appliance capable of general use and easy to manufacture. Photographed from the exhibit in the National Museum, Washington.



The Berliner gyrocopter in a short experimental flight, "skimming the daisies."

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Mechanical Handling

Loaders and Unloaders that

By Matthew



Fig. 1. Simple belt conveyors can be used for unloading fine materials direct from car to storage pile.

EVERY year, especially during the winter months, the press of the country proclaims a car shortage. This car shortage is not limited to any one period, but is restricted to seasonal conditions, i. e., in the summer time there is a shortage of cars for the shipment of fruit to large municipal centers; in the fall there is a shortage of cars for shipping grain from the farms to the grain elevators and mills; also at the same time of the year there is a shortage of cars for the transportation of coal. In most cases, the public is inclined to place the entire blame for these car shortages upon the railroads. It is true that they are largely responsible, but the shipper and receiver are also partially at fault, the reason being that they do not unload cars immediately upon receipt at the various destinations, and when they do load or unload them, the more modern and efficient methods are not always employed. Only recently the writer saw a gang of men shovelling coal from under gondola cars, and wheeling it to the storage piles, taking days to unload a few cars which could have been unloaded in a very few hours.

If a simple belt conveyor like that shown in figure 1 had been installed, the result would not only have been the immediate release of much needed coal cars, but the small plant executive could have used the common labor more advantageously elsewhere about the plant, and substantially reduced his handling costs.

Fig. 2. Belt conveyors in combination with special unloading conveyors handle large material direct from cars to trucks or pile.



Fig. 4. A portable belt conveyor equipped with gasoline engine and large automobile wheels can easily be trailed to public sidings for unloading from cars to trucks.



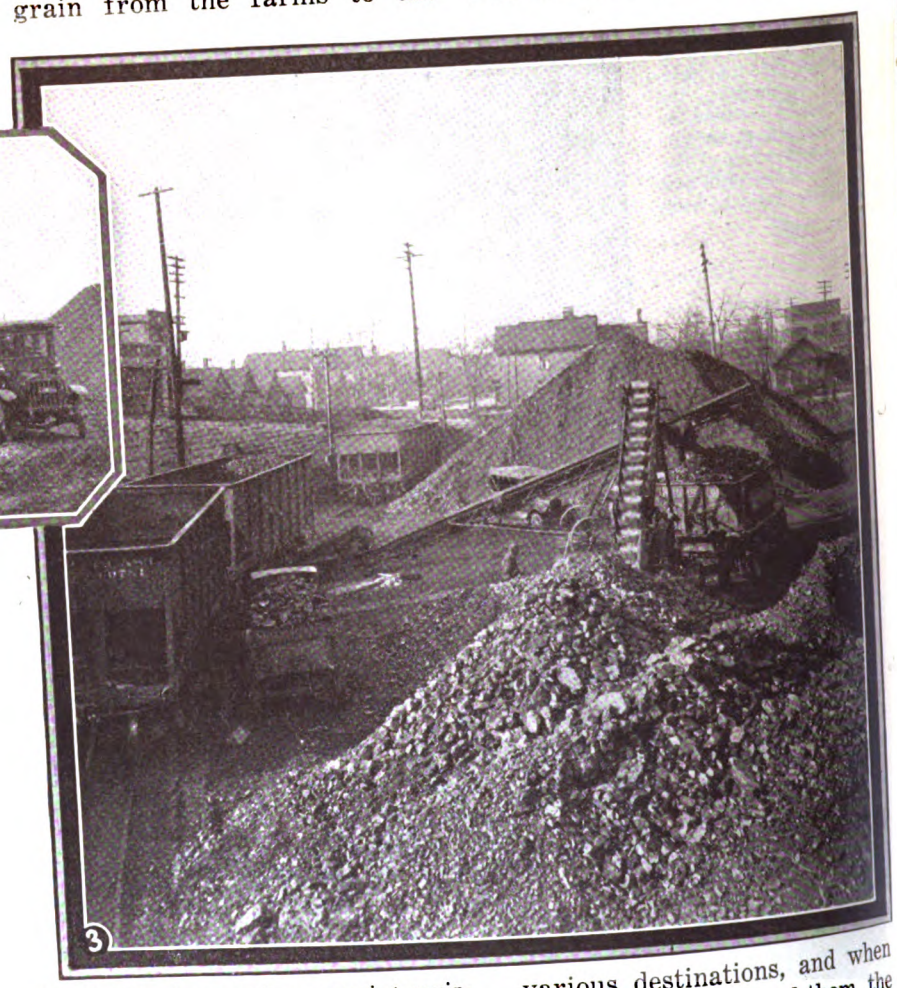


Fig. 3. This shows entire conveying equipment required by small retail coal yard. The portable bucket elevator is used to reclaim coal from pile and loads it direct to truck.

Fig. 6. Portable sections of gravity conveyor materially assist in loading and unloading case goods from box cars.

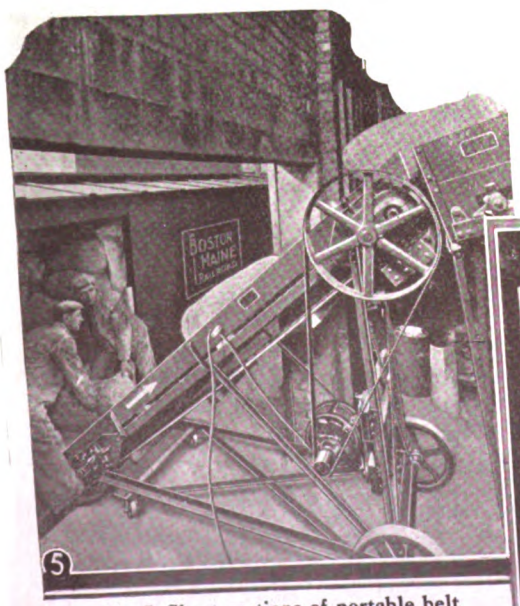




Fig. 5. Short sections of portable belt conveyors materially assist in unloading sack goods from cars, and delivering to plant conveying systems.

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and the Car Shortage

Avoid Unnecessary Delays

W. POTTS

As the illustrations show, many executives and business men have realized the money savings that can be made if efficient material handling methods are used on the loading and unloading of coal. Figure 2 shows á small unit combination which entirely eliminates the necessity of shovelling large materials from cars to trucks. The piles shown in the background have also been handled by the use of additional portable belt conveyors.

Figure 3 shows a somewhat similar commercial coal yard, with the addition of a bucket elevator loading device for reclaiming the coal from piles and loading it to trucks. This equipment permits speedy handling of materials from cars to pile, thereby releasing the cars and returning them to the railroad for further loading, and also assists the coal dealer in keeping his trucks busy, making more deliveries in a day than would be the case if all the material had to be shovelled by hand.

While these illustrations are shown in commercial coal yards, there is no reason why the same equipment cannot be installed in a number of small industrial plants, where hand methods are now employed. The commercial coal dealer has made so much money in the last few years, that he has started to spend more on mechanical equipment, because he realizes that in this way it is possible to reduce his direct labor expenses, thus acquiring even larger profits.

The unloading equipment shown in figure 4 is a portable

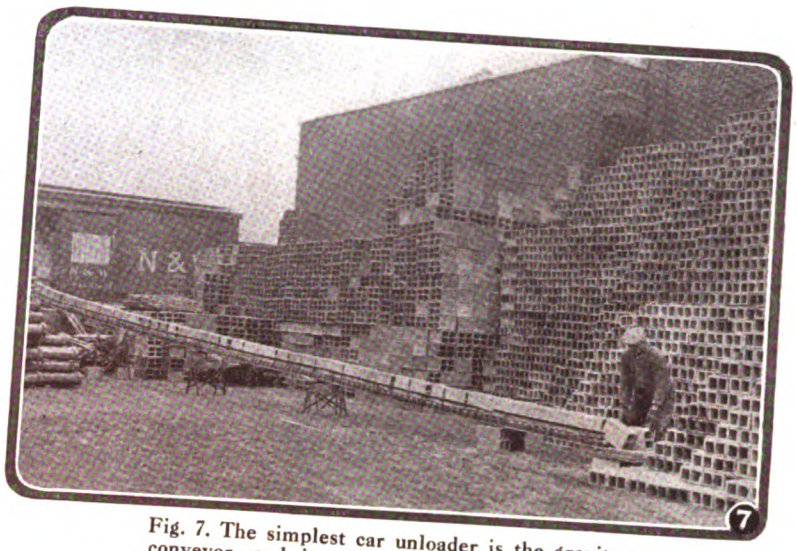


Fig. 7. The simplest car unloader is the gravity conveyor, and is used as shown for handling hollow tiles and building materials, etc.



Fig. 12. Fixed installations of all classes of conveyors are frequently used for car loading or unloading.

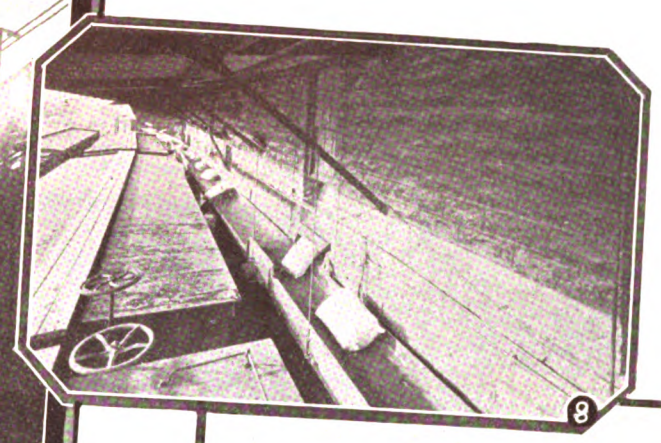


Fig. 8. Belt conveyors are here used as car loaders, conveying the bags from sewing machines direct to individual cars without the assistance of manual labor.

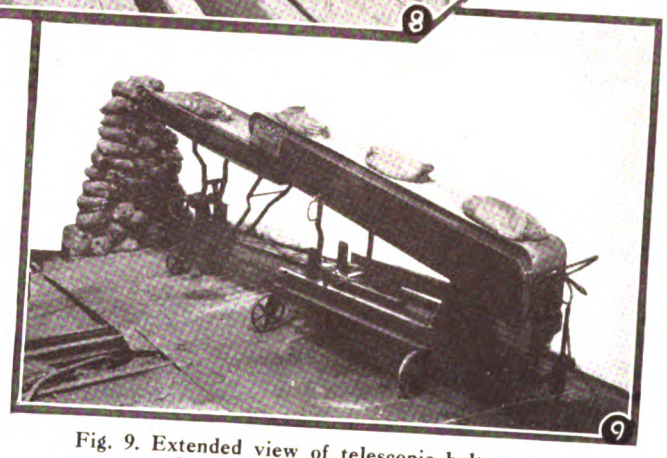


Fig. 9. Extended view of telescopic belt conveyor for loading sacks to box cars.

Fig. 11. Gravity conveyor designed especially for handling shingles for loading to box cars.

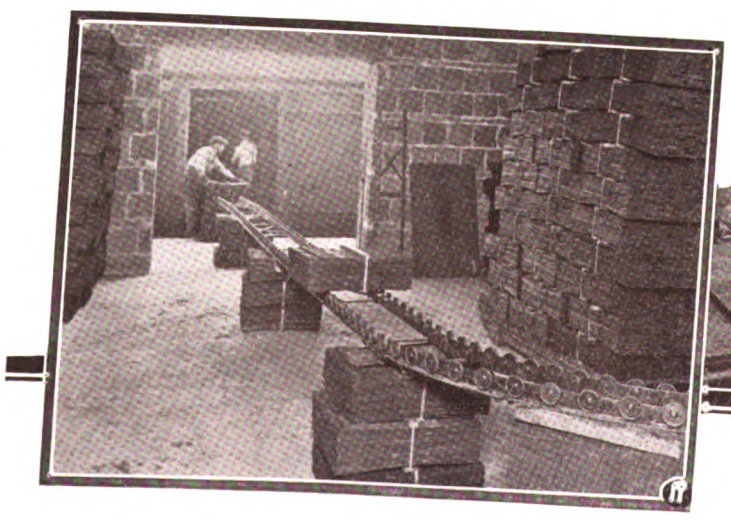
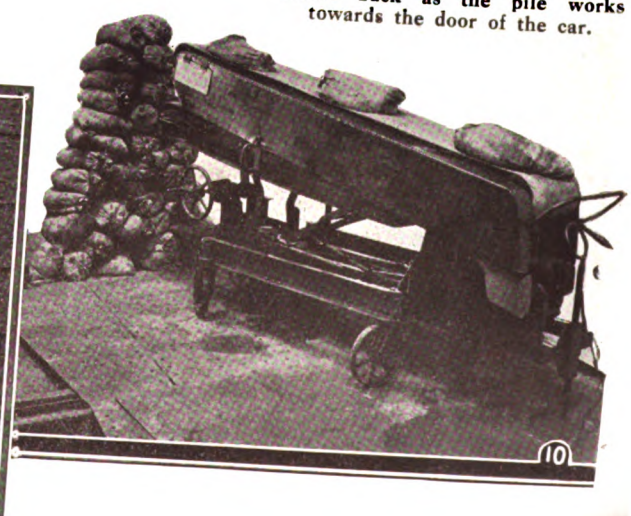


Fig. 10. Same conveyor as shown in figure 9, with telescopic section drawn back as the pile works towards the door of the car.



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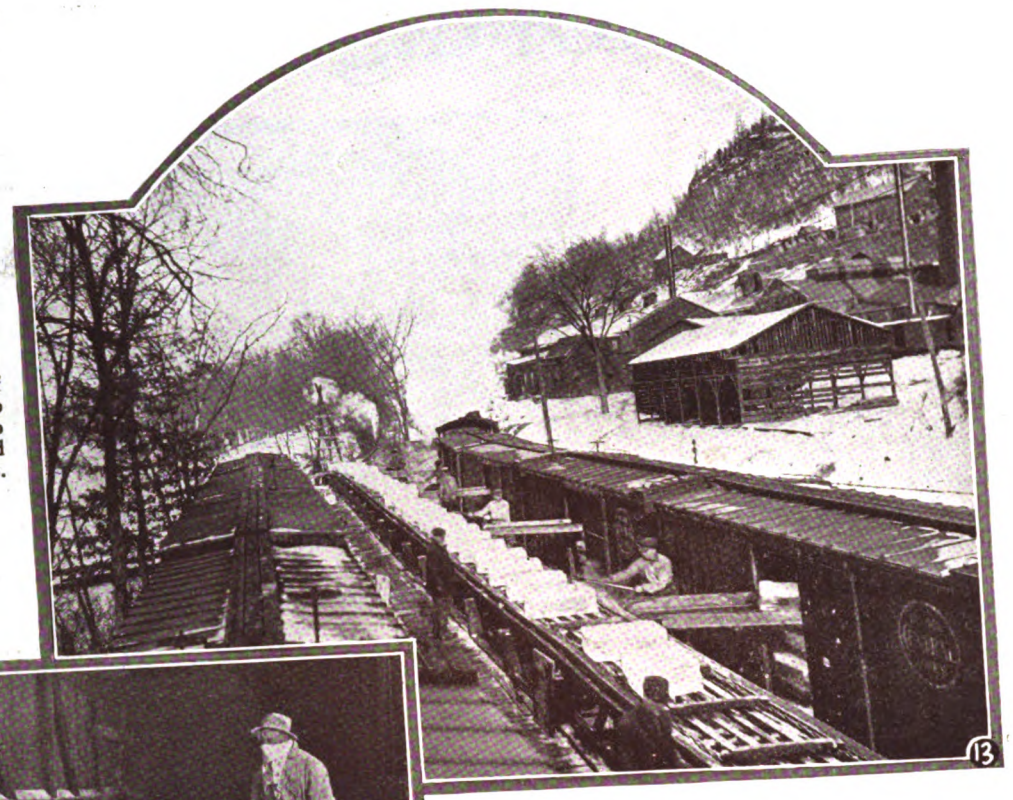


Fig. 13. The operation of loading ice from pond to cars or from ice-house to cars is usually performed by mechanical conveyors.



Fig. 14. Power shovel for unloading bulk material into elevator which carries it to storage bins.

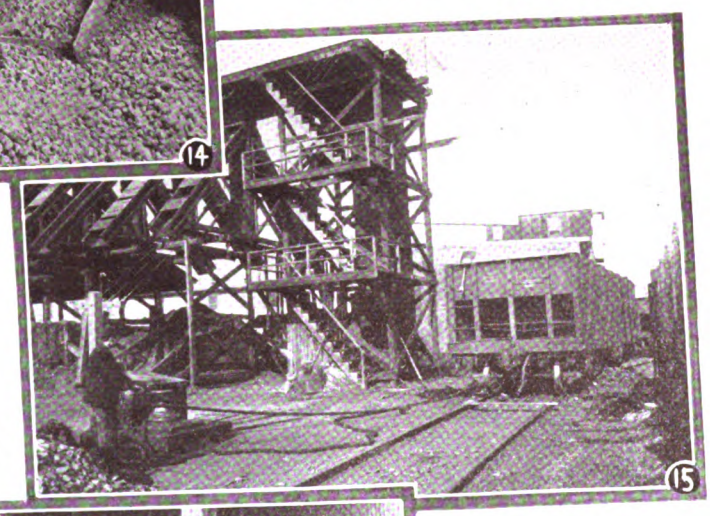


Fig. 15. Power car-pullers for shifting loaded or empty cars materially assist mechanical unloading devices.



Fig. 16. Belt conveyors on adjustable booms are reducing the cost of loading coke.

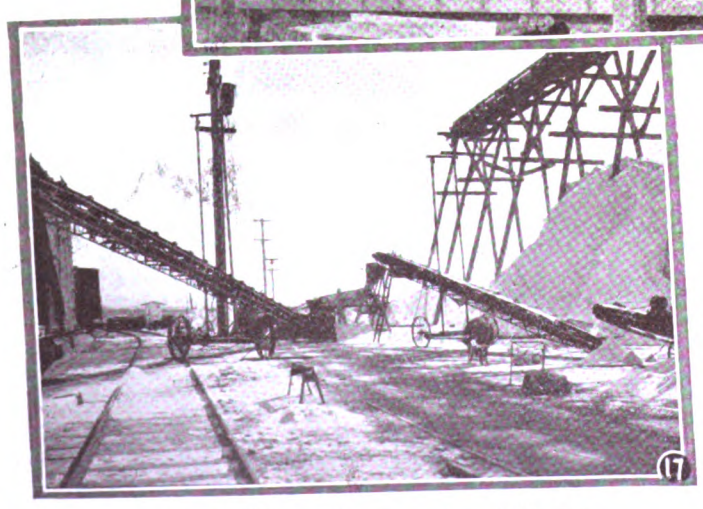


Fig. 17. This combination of portable conveyors handles salt direct from pile, through screens, to box cars as shown with a very small labor expense.

belt conveyor, driven by a gasoline engine, but instead of being equipped with large iron wheels, and light framework, it has been designed with a heavier framework and axle upon which Ford truck wheels with pneumatic tires are mounted. This particular machine was built for the operation which it is performing, namely, unloading hopper bottom coal cars from team tracks into trucks. The idea of equipping it with pneumatic tires was to afford a greater portability. The owner of this machine operates in a very large city, and it is necessary to transport the unloader to the various railroad sidings, located frequently a mile or so apart. With the standard type iron wheels, the trailing of this equipment would not be practical over rough pavements and unimproved streets, while with pneumatic tires, there is no road but what this machine can be taken over it with perfect safety. Being equipped with a gasoline engine, it can be taken anywhere, and is always ready for service.

This same type of machine has been purchased and is being used by several contractors, for handling sand, gravel, crushed rock and similar materials.

Industrial plants are still backward in the use of car loaders and unloaders, although many unique devices are now operating in industrial plants on these important operations. Figure 5 shows a portable belt conveyor handling sacks of material direct from cars to the plant's internal belt conveying system, which carries the sacks to storage. This simple device materially reduces the unloading labor expense, speeds up the

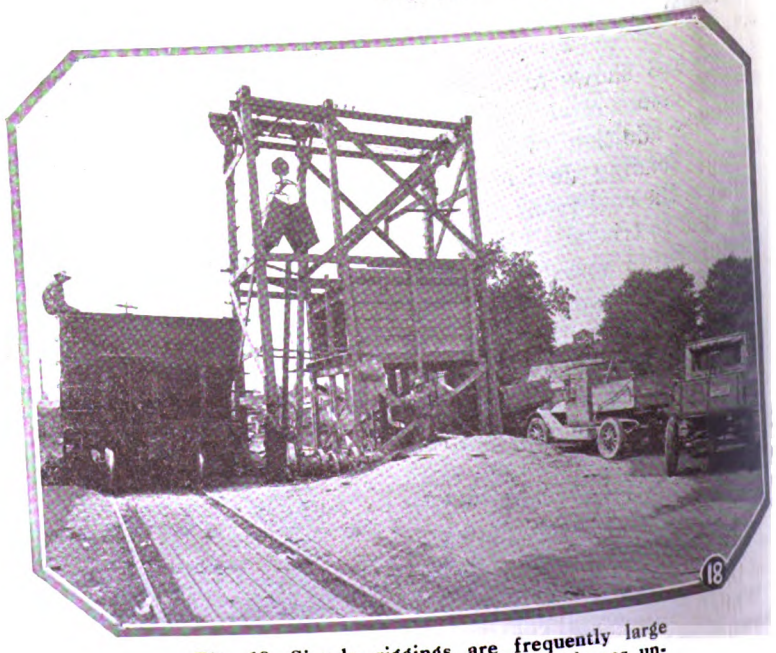


Fig. 18. Simple riggings are frequently large money savers, as was the case of this car unloader for handling road building materials.

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operation so that a car can be unloaded in about one-third the time that would be required if hand truckers were employed, and in addition, elevates the materials, so that the belt conveyors transporting the sacks within the plant can be suspended from the ceiling, permitting the use of valuable floor space for other purposes. This reduces confusion and congestion in the building through which the materials must pass in going to the storage space.

It is not only in the unloading of sacks that simple devices are employed to good advantage, but in bottling works, particularly in plants manufacturing soft drinks and other light beverages, gravity conveyors have long been employed as means of assisting in the quick loading of cars of finished bottled goods, and the unloading of return bottles or new bottles, for refilling in the plant. Figure 6 is a view in the plant of the Anheuser-Busch Company, St. Louis, Mo., and shows how the gravity conveyor is mounted on caster stands, to assist its portability. By using this conveyor, the time for loading a car is very short, and as many cars have to be loaded in a day, it is necessary to save every minute possible. For shipping this material, refrigerator cars are required, and as these are scarce, it is imperative that they be loaded the same day they are spotted on the plant siding.

Gravity conveyors can also be employed for handling goods direct from box cars to yard storage, as shown in figure 7. The plant executive who is considering the construction of a new building, should give serious



Fig. 19. A view of the simplest car unloader for pig iron, namely, short sections of conical gravity conveyor and manual labor.



Fig. 20. Caterpillar turntable crane equipped with magnet or grab bucket can be used about the yard and for car loading and unloading.

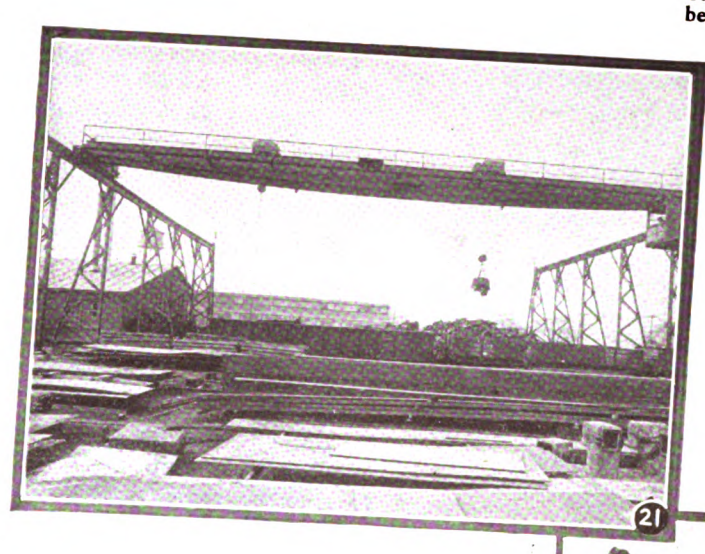
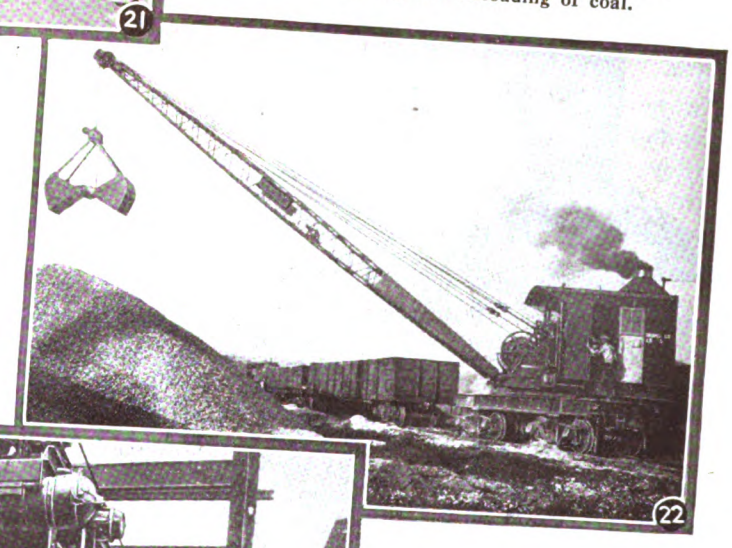


Fig. 21. For pig iron, scrap metal, and large sheet metal, operating over a large yard area, electric travelling crane, equipped with magnet as shown, has been found very efficient, both for car loading and unloading.

Fig. 22. Locomotive cranes with grab buckets are used extensively for the loading and unloading of coal.



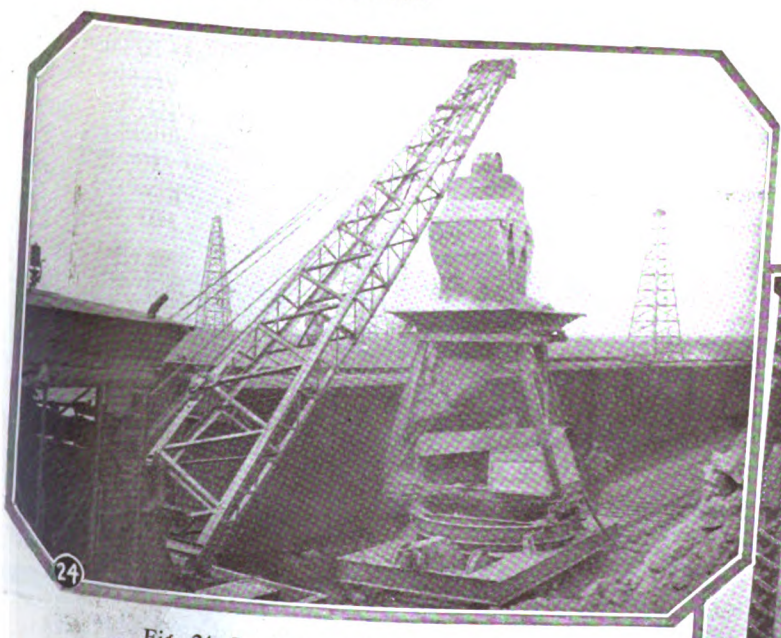


Fig. 24. Loading sulphur from storage pile and placing same in box cars by means of locomotive crane and mechanical car loading equipment.



Fig. 23. Cab operated monorail telpher systems with grab buckets make excellent car unloaders in congested quarters.

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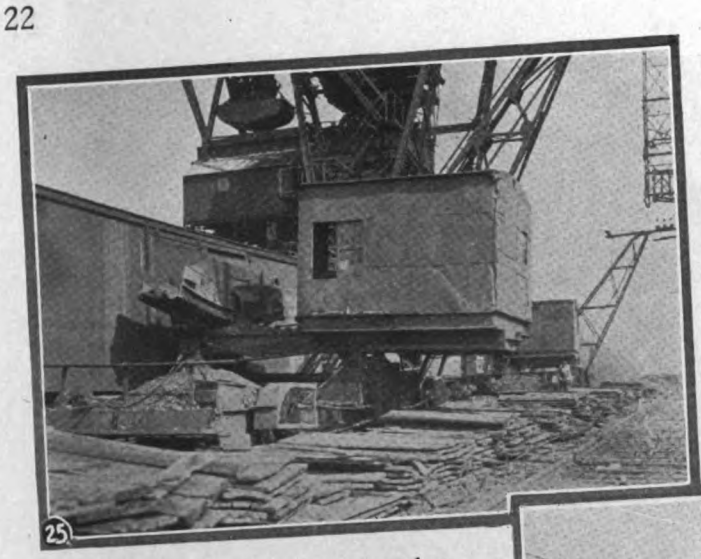


Fig. 25. View showing two pusher-type car unloaders operating at the coal docks on the Great Lakes. The further loader is in the car, while the one in the foreground is withdrawn.

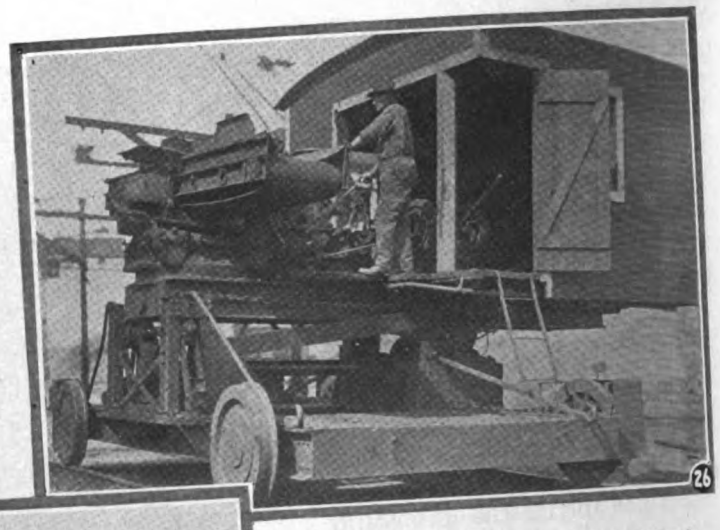
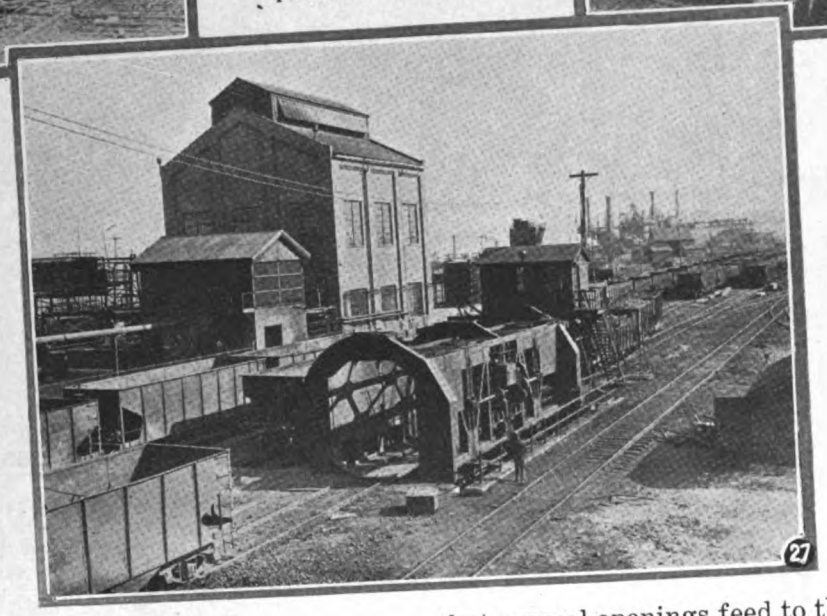


Fig. 26. General view of large tonnage rubber belt box car loader.

Fig. 27. Rotary car dumpers capable of unloading large gondola cars are now being successfully operated at many plants, terminals, etc.



thought to the use of such simple equipment so as to reduce the handling costs of unloading.

Where large tonnage and several cars are to be loaded in a day, particularly if sacks are being handled, the installation of a flat belt conveyor running the full length of the shipping platform as shown in figure 8, will be found one of the best methods of car loading. It will be noted that several openings feed to this belt conveyor through the side wall of the building. These openings come direct from the sewing machines, after the bags have been filled. By simple scoops, placed diagonally across the conveyor, the bags are diverted down chutes directly into the car for stowing.

In the matter of stowing within the car, where the feed is continuous, handling costs can be further reduced by installing a telescopic portable conveyor as shown in figures 9 and 10. Figure 9 shows the conveyor extended to its full length, for placing the bags at the extreme ends of the car. This saves the man stowing the bags the effort of walking and carrying the bag from the car door to the end of the car when piling. It also permits one man to perform the operation instead of two or three. When the first pile is complete, and it is desired to start a second, third, or fourth pile, working toward the car door, the operator simply turns the hand wheel, thus pulling the telescopic section in under the first section of the conveyor, reducing the over-all length eventually to the shortest possible point, as shown in figure 10.

When the car is filled so that there is no room for the machine to operate, it is removed, and the remainder of the piling can be easily done by taking the bags direct from the conveyor chute as they fall very close to the place where they will be stowed in the car.

For years, the loading of shingles has been done by hand truck methods, as it was practically impossible to find any type of mechanical equipment which would convey the awkward bundles from storage to the cars. Many devices were tried, and eventually it was decided that some form of gravity conveyor would solve this problem. It was found impractical to use the standard roller gravity con-

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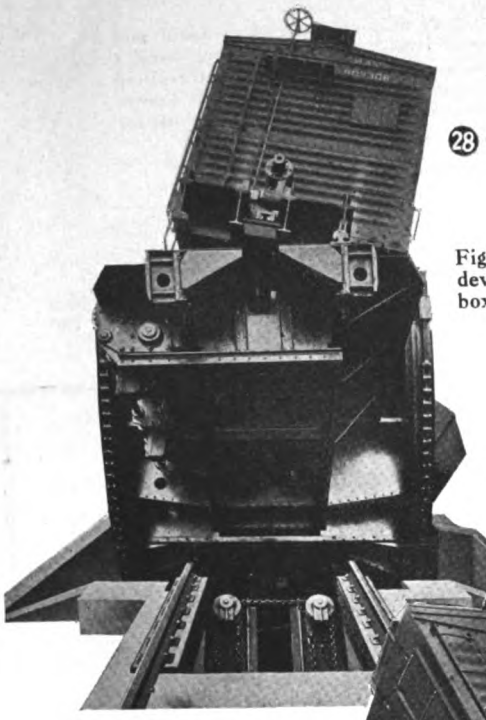


Fig. 28. With this special tipping device, it is possible to unload a box car of bulk material in about five minutes' time.

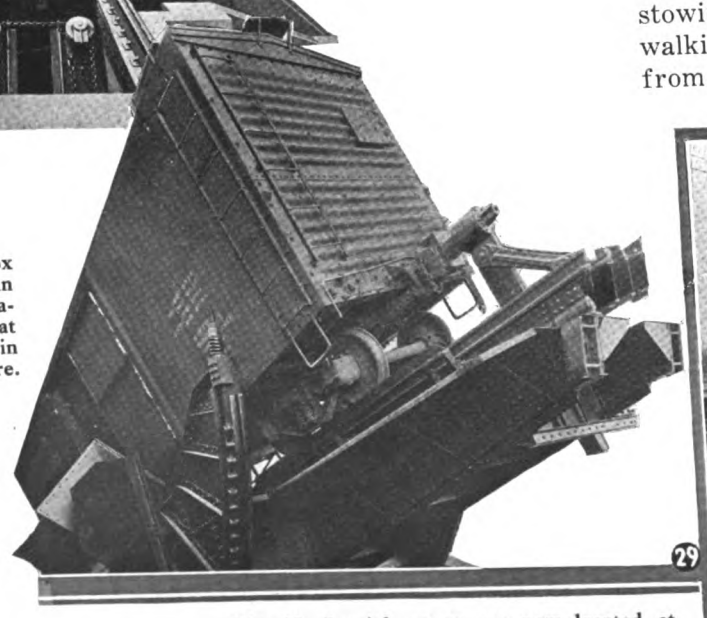


Fig. 29. Side view of box car unloader shown in figure 29. This installation is now operating at municipal pier No. 40 in the city of Portland, Ore.

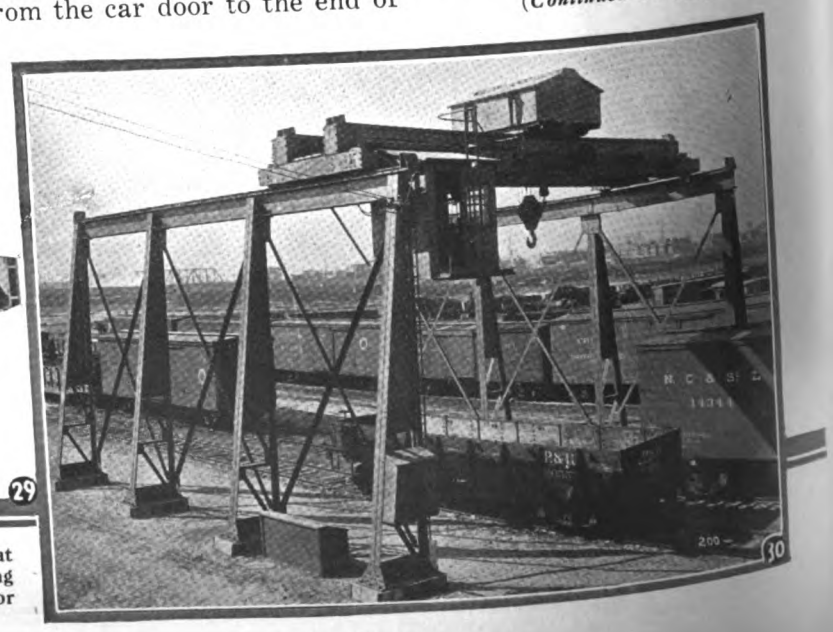


Fig. 30. Special cranes are now located at railroad freight terminals for unloading heavy equipment, etc., from cars to motor trucks or wagons.

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The Oxy-Acetylene Flame in Industry

By J. F. Springer

THE oxy-acetylene process, now in use all over the United States, is nevertheless a comparatively new method. So far as is known to the writer, his own hand-book, published in 1912, was the first considerable treatment of the method on this side of the Atlantic. There are two gases involved, oxygen and acetylene, and this fact is reflected in the name. Both of these gases, in a relatively pure state, are fed through the nozzle and tip. The oxygen in the surrounding air plays no part in the generation of the intense heat produced.

It is possible, under proper conditions, to obtain very high temperatures with the oxy-acetylene torch. Such thermal levels as 5000° and 5500° F. are claimed. And it is doubtless to such temperatures that the wonderful success of the process is due. However, the enormously high temperatures are obtained only in a very restricted region of the flame. This requires explanation. It is advisable, in fact, for the reader to understand roughly what are the reasons for the high concentration of heat.

When the mixture of oxygen and acetylene issues, under pressure, from the orifice of the tip, the acetylene is decomposed by an explosive action into its constituent elements, carbon and hydrogen. This means three substances travelling the same route, oxygen being the third. Apparently, there is little or no recombination for a short interval. But when a distance, measured in fractions of an inch for all the more usual sizes of torch, has been covered, the carbon and the oxygen combine to form carbon monoxide. While the carbon is flowing along in an uncombined state, it shines with a very white light. This little white flame, terminating when the carbon unites with the oxy-

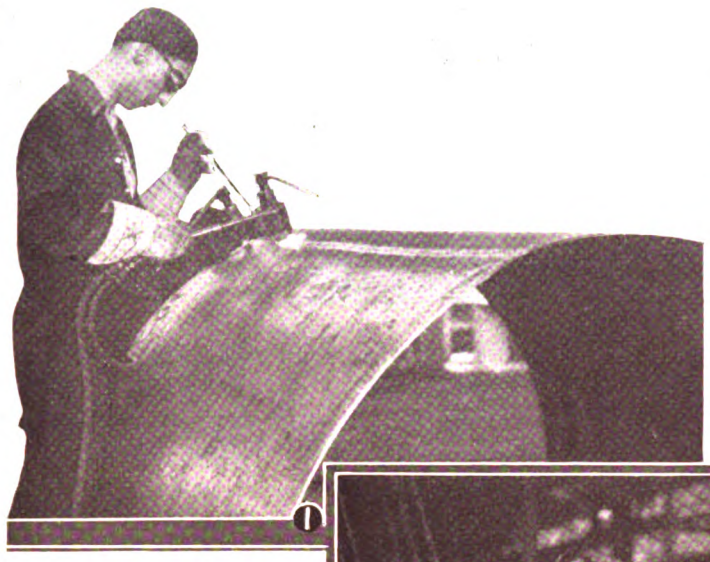


Fig. 1. Welding side seam on section of steel storage tank. The clamps shown hold the rolled plate in position for welding.



Fig. 2. Machine gear guard being built by welding. Often used pieces of sheet metal may be fabricated into useful equipment by welding.



Fig. 3. The welding of oil pipe lines saves time in installation, and prevents loss of material through defective joints. Hundreds of miles of welded pipe are in daily use throughout the country.

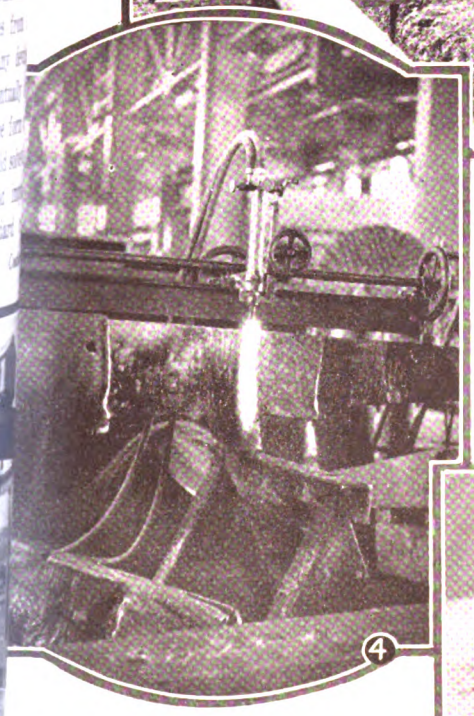


Fig. 4. Cutting rudder for steamship from steel slab with mechanically guided oxy-acetylene cutting blowpipe.

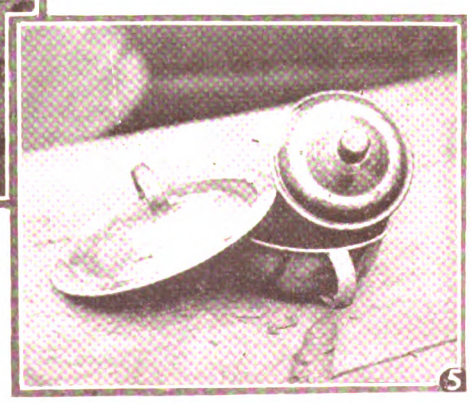


Fig. 5. The handles and attachments of these utensils are oxy-acetylene welded—a vast improvement over soldering.

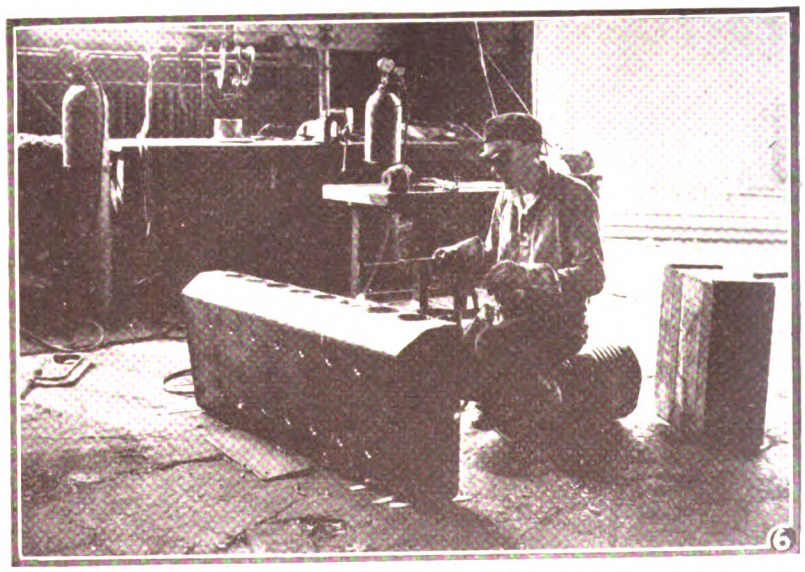


Fig. 6. Welding tubes in smoke consumer. This equipment was made of scrapped sheet and scrapped pipe entirely with oxy-acetylene cutting and welding blowpipes.

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Fig. 7. Cast iron melting pots for lead reduction (similar to the one shown here being welded) are damaged through expansion and contraction stresses in use. By oxy-acetylene welding, they may be satisfactorily and economically repaired. The pot being welded here is the property of a mining company in Mexico.

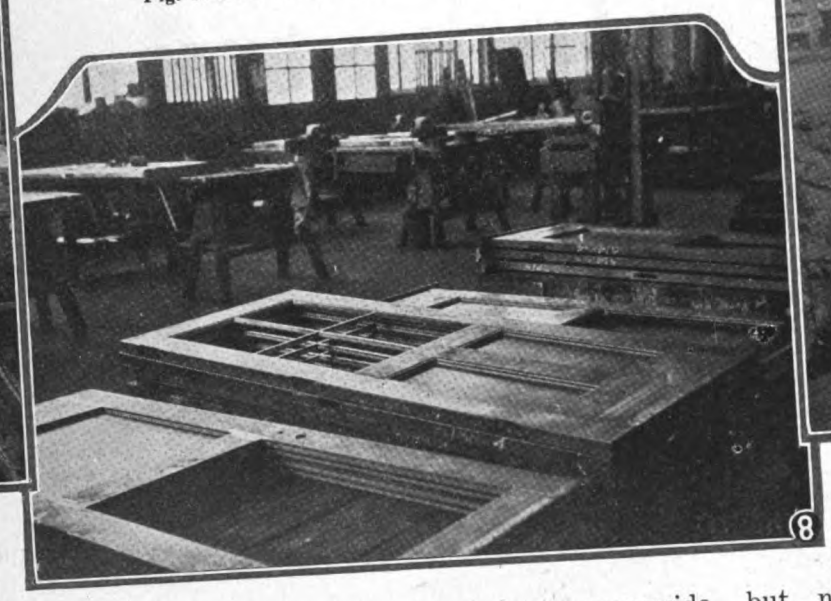


Fig. 8. Sheet metal doors fabricated by welding.



Fig. 9. Welding nipple on all-welded pipe line built to carry city gas under pressure.

gen, is a notable feature of the burning mass of gas constituting the whole flame. At its forward end, or perhaps a trifle beyond, is the hot spot. Here are realized the great temperatures, and here are the metals reduced to the molten state.

The entire flame is quite large, but the envelope, which surrounds the little white flame and the hot spot and extends a very considerable distance beyond, is not excessively hot. In fact, the very hot part of the whole flame is only a small fractional portion.

It is in fact the concentration of a large part of the total heat produced that makes possible such temperatures as 5000° and 5500°. The writer understands this concentration of heat to be the result of limiting the combination of carbon and oxygen to carbon monoxide.

Carbon unites with oxygen to form both a monoxide and a dioxide. In the former case, it is understood that one atom of carbon unites with one atom of oxygen. In the latter, there is a union of one atom of carbon and two of oxygen. In the oxy-acetylene torch, this latter combination is prevented and the former brought about by the limitation of the proportion of oxygen fed through the torch. That is, enough oxygen is supplied to convert the carbon into carbon monoxide, but not enough to convert it into the dioxide. This limitation of the oxygen apparently brings about the high concentration of heat.

There is a similar method which may be termed the oxy-hydrogen process. It uses the two gases oxygen and hydrogen and obtains its heat when they combine. The heat is not so largely concentrated at any one point as is that of the oxy-acetylene flame. It is a good procedure for certain work and is especially useful when, by means of an added oxygen jet, the torch is to be used in cutting steel. But, the oxy-acetylene process has apparently won a superior position in the industrial world. I attribute this largely to the fact of the high concentration of heat at the hot spot.

Ten years ago, there were commercial torches on the market which secured the concentration of heat at the hot spot by using 1.26 or less volumes of oxygen to one volume of acetylene. Theoretically, the proportion ought to be one volume of each. The excess actually required is to be understood as necessary in order to provide for imperfection in mixing the two gases prior to their emergence from the torch. Some torches provide better mixing than do others and in consequence use less oxygen. This is important because of the fact that the less oxygen we use, the less the expense. The matter admits of determination in the

Fig. 10. Cutting rim of huge cast iron fly wheel with oxy-acetylene blowpipe. The metal cut in this case measured 16 by 18 inches.

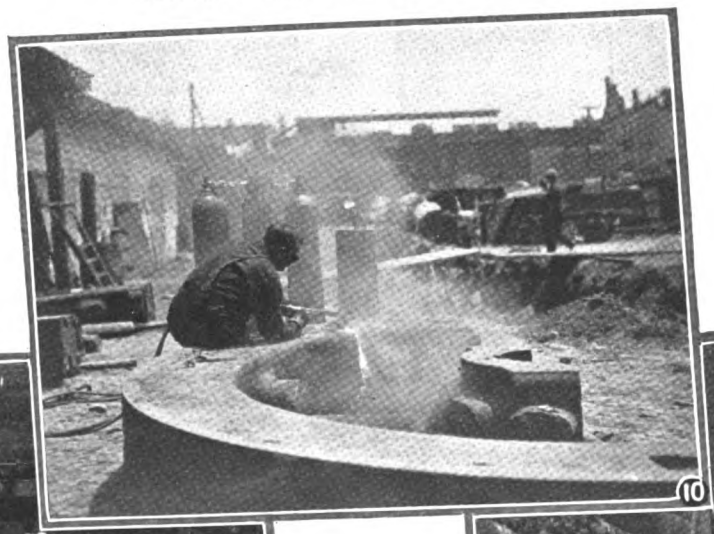




Fig. 11. Building up parts of manganese steel on a casting worn in service.

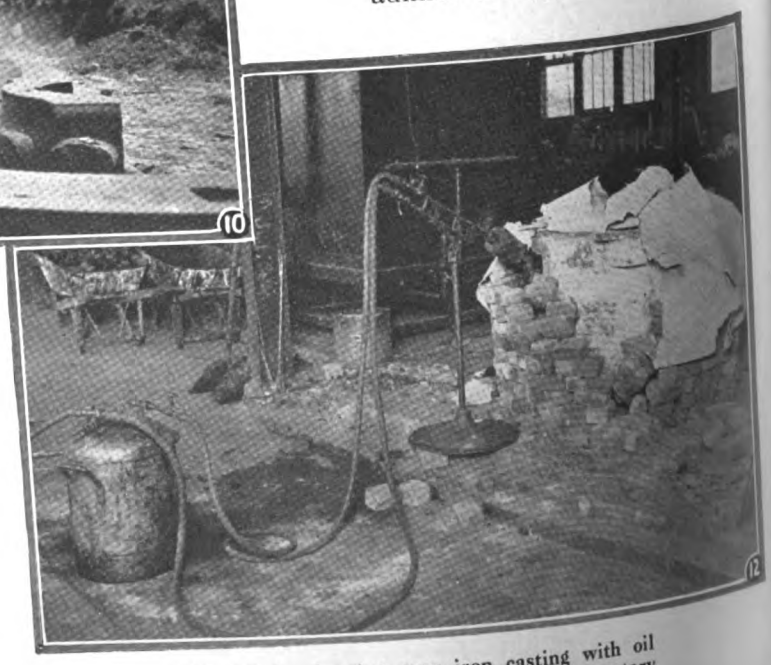


Fig. 12. Pre-heating gray iron casting with oil and compressed air pre-heating unit preparatory to welding.

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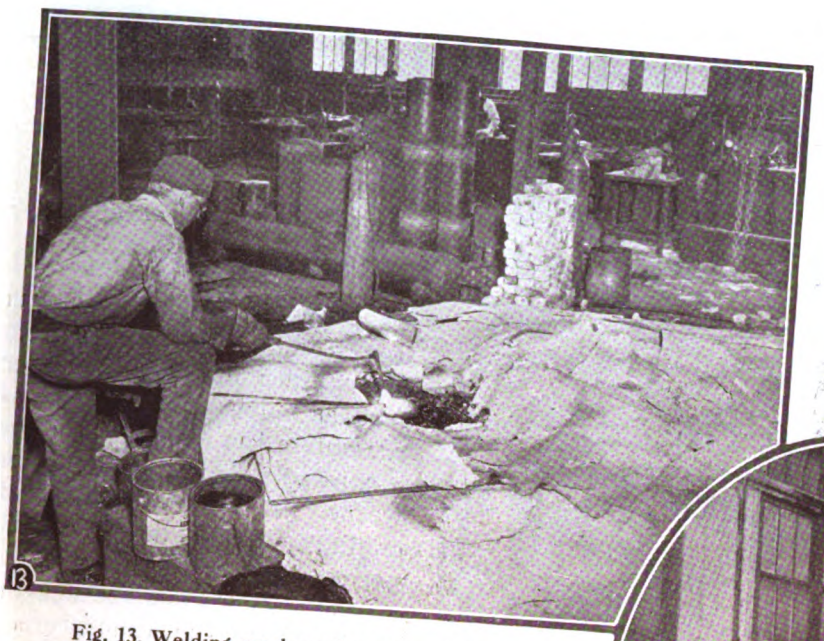


Fig. 13. Welding pre-heated casting. Asbestos paper protects operator from heat of pre-heating fire, prevents radiation of heat and protects casting from drafts.

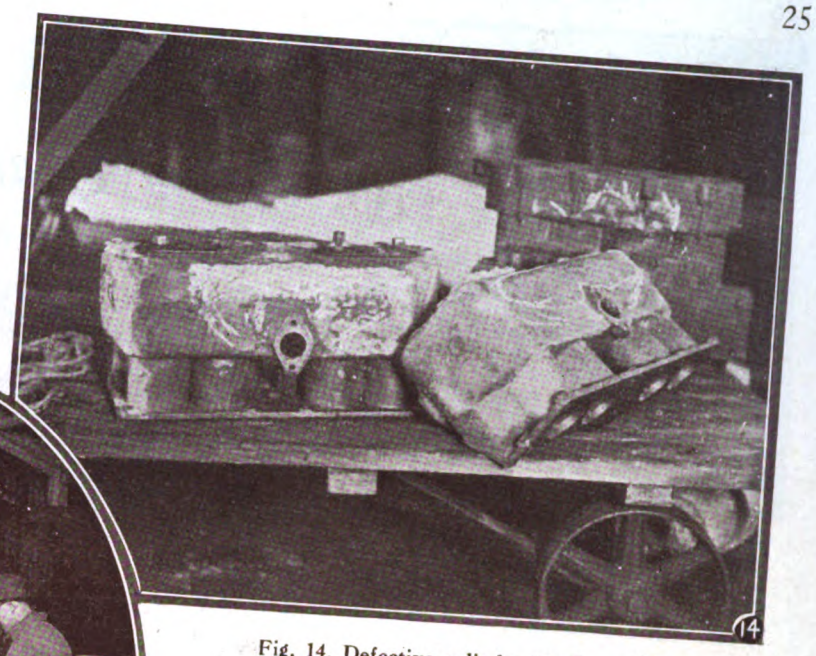


Fig. 14. Defective cylinder block castings welded in foundry.



Fig. 15. Welding longitudinal seam on dredge pontoons.

case of any torch simply by measuring the amounts of oxygen and acetylene used in operating the torch over any interval of time.

In a representative torch, the two gases will be received separately and will be discharged as a mixture. The proportions in the mixture may be regulated by controlling the amounts of the two gases supplied to the mixing chamber. In fact, the appearance of the white flame provides a delicate test which shows when the mixture being formed contains precisely the right proportions. That is to say, the white flame should be single and should also be quite sharply defined. The flame is then said to be normal. It is possible to adjust the torch differently, and to use the abnormal flames produced. Thus, we may use less oxygen than the amount necessary to give the single, sharply defined white flame. In this case, we avoid, more or less perfectly, pouring an excess of oxygen onto the highly heated work. Such a flame is useful in welding copper. But for usual procedures, the normal flame is the one wanted. It is, accordingly, very fortunate that we have an easy and exact method of testing the adjustment. In fact, as the workman goes on with his welding, he is able to detect any change in his flame and to correct it easily and thoroughly, the appearance of the little white flame being a sufficient guide.

The term *welding* is wrongly applied to the process of uniting metal by the oxy-acetylene and the oxy-hydrogen processes. But everybody, pretty much, uses it; so that it is necessary to recognize the extension of meaning. In the old time welding done on an anvil by the blacksmith, two pieces of iron or steel are heated to a temperature round 1900° F., and then

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Fig. 16. Broken stove pattern being repaired.





Fig. 17. Punch press frame damaged in use, quickly returned to service by oxy-acetylene welding.

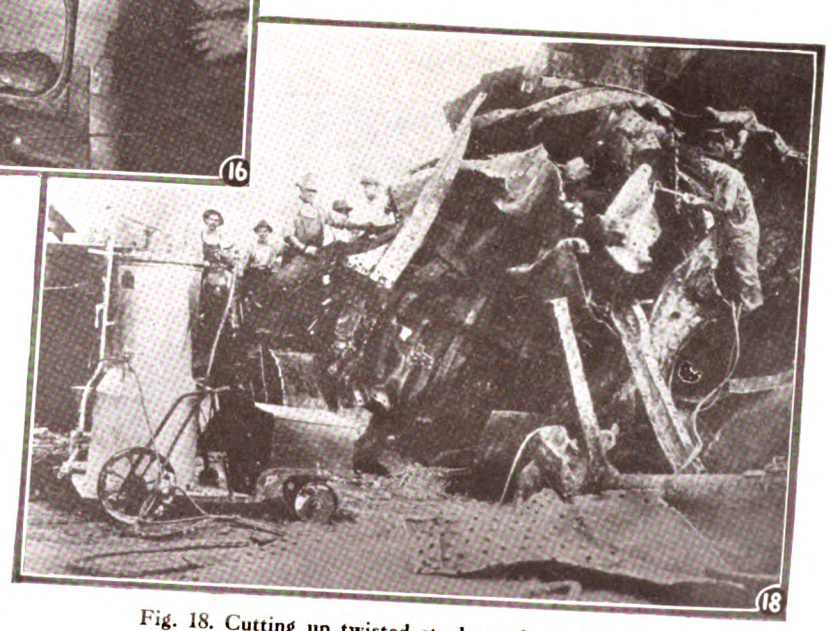


Fig. 18. Cutting up twisted steel wreckage, for removal; a job which has been greatly simplified through the acetylene flame.

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Making Steam Do Double Duty

Power and Heat from Exhaust Steam

By James T. Beard, 2nd

In previous articles we have pointed out the necessity for economy in the generation of steam power in the boiler house, if the steam department of the industrial plant is to be placed upon the same sound and businesslike basis as other departments of the mill. This same principle of economy must equally apply to the use of the steam generated, not only in the many industrial and heating processes, but also in the engines and turbines, which develop mechanical and electrical power for turning the wheels of the plant.

In the central station the economical use of the generated steam presents a simple problem, since the only service to which it is put is for driving the prime movers and auxiliaries. The multiplicity of uses for steam in the industrial plant, however, together with the wide variations in the steam demand and power requirements, make the problem more complex.

The chief steam problem in the average industrial plant is what to do with the exhaust steam. Operating engineers know that by far the greatest amount of heat in steam at any given pressure is that heat which must be put into it, in order to convert it from water into the vapor state. After water has once been changed to steam, the addition of only a comparatively small quantity of heat is sufficient to raise its pressure from atmospheric up to the operating pressure of the boilers. Roughly speaking, steam that has been exhausted from the engines has nearly 90 per cent. as much heat in it as was present in the live steam before it entered the engines. In other words, in the development of engine or turbine power, only 10 per cent. of the total heat in the steam is used, when the steam is exhausted to the atmosphere.

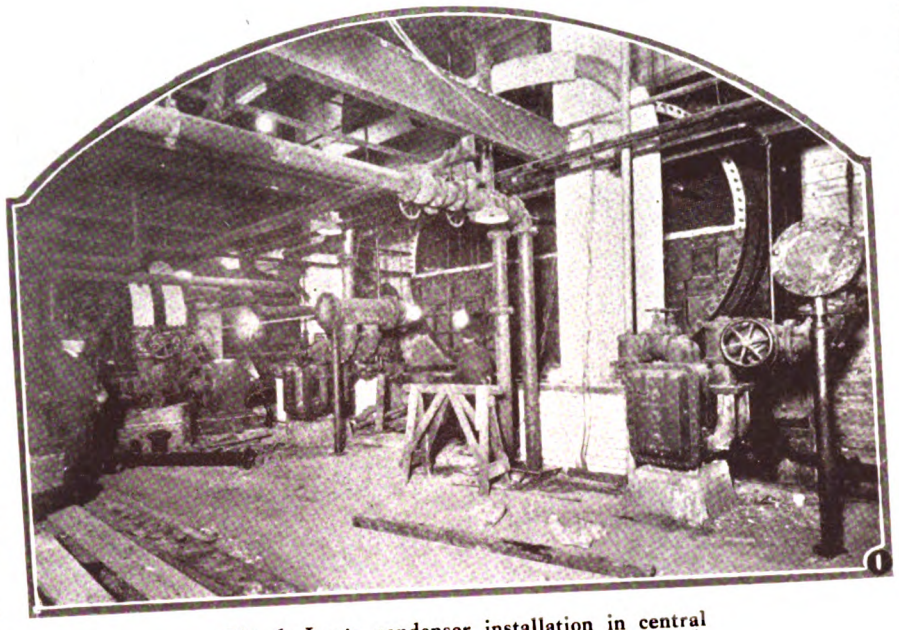


Fig. 1. Large condenser installation in central station. This condenser is of the surface type, *i. e.*, the cooling water and exhaust steam do not come in actual contact with each other. Note the condenser auxiliaries in the background.

If this exhaust steam is permitted to go to waste, therefore, the corresponding loss amounts to a very considerable proportion of the amount of coal burned. One way of conserving this heat is by forcing the steam to surrender more of its heat during its expansion in the engine cylinder or in the steam turbine. By doing this the prime mover is made to develop a greater horsepower for the same amount of steam, or the same horsepower for a considerably less amount.

This reduced steam consumption, or increased engine economy, is accomplished by reducing the back pressure on the engine. In other words, a vacuum is created on the exhaust side of the piston, so that the pressure of the live steam on the other side forces the piston ahead against less resistance. The lower the back pressure, the greater will be the steam expansion, and the more work will be done by the engine when using the same weight of steam.

With suitable apparatus the back pressure on any engine or turbine may be reduced to a point far below the normal at-

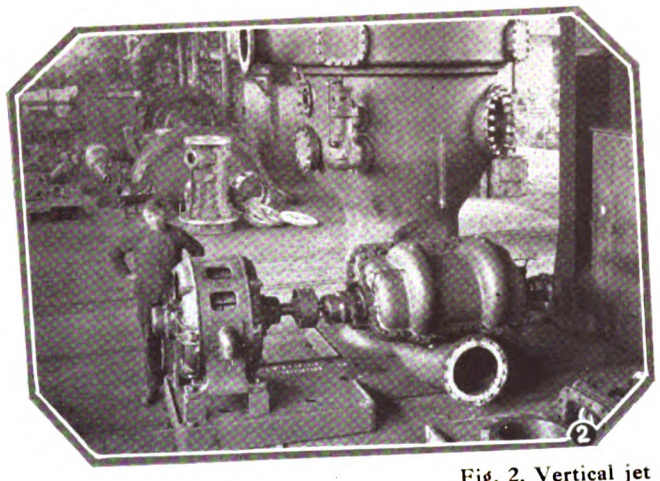


Fig. 2. Vertical jet type of condenser with motor-driven double runner removal pump. In this type of condenser, the cooling water and steam are mixed.

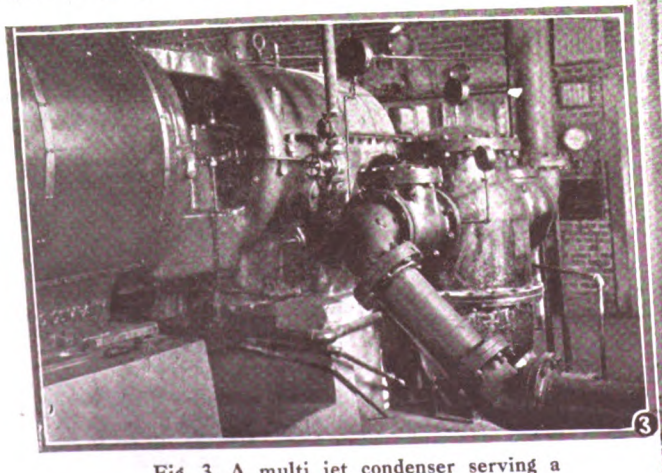


Fig. 3. A multi jet condenser serving a 300 kw. turbine, driving an electric generator.

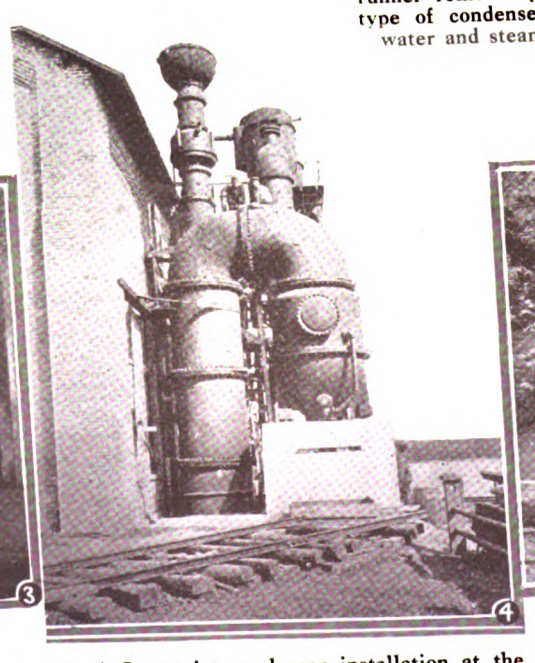


Fig. 4. Large jet condenser installation at the Dominion Coal Company, Nova Scotia.

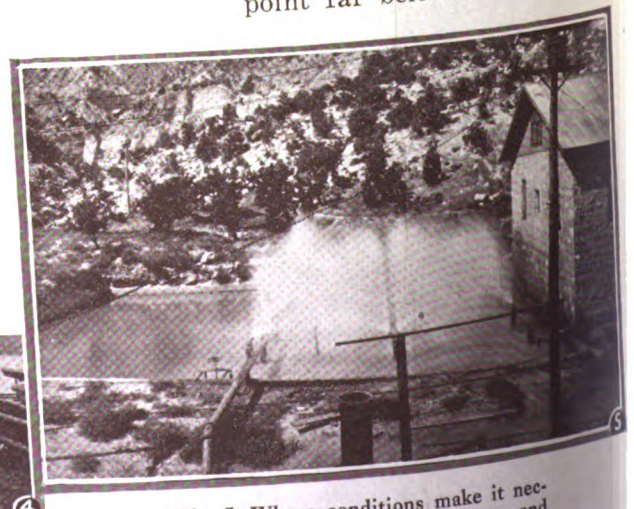


Fig. 5. Where conditions make it necessary to use cooling water over and over again, it is often effectively cooled by spraying it into a pond or reservoir. The resultant evaporation lowers the temperature.

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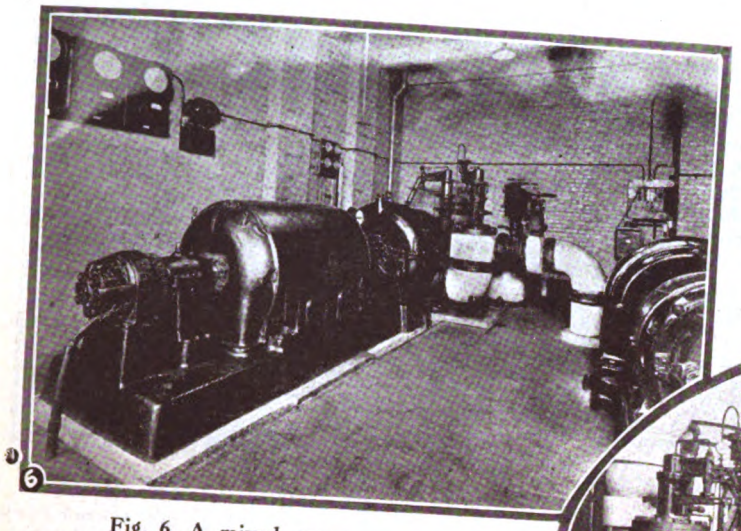


Fig. 6. A mixed pressure type of turbine operating at 28 inches vacuum, and driving a 500 kw. electrical generator.

Fig. 8. A bleeder type of turbine installed in the paper manufacturing plant of C. H. Dexter and Company. The low pressure end of this turbine exhausts into a 28-inch vacuum. Steam for heating may be bled from the intermediate stages of this turbine, after having developed power by expansion in the high pressure stages.

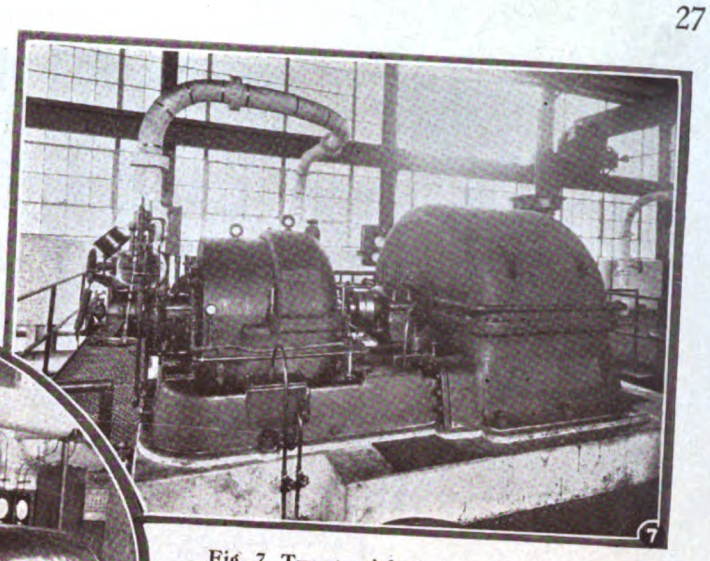
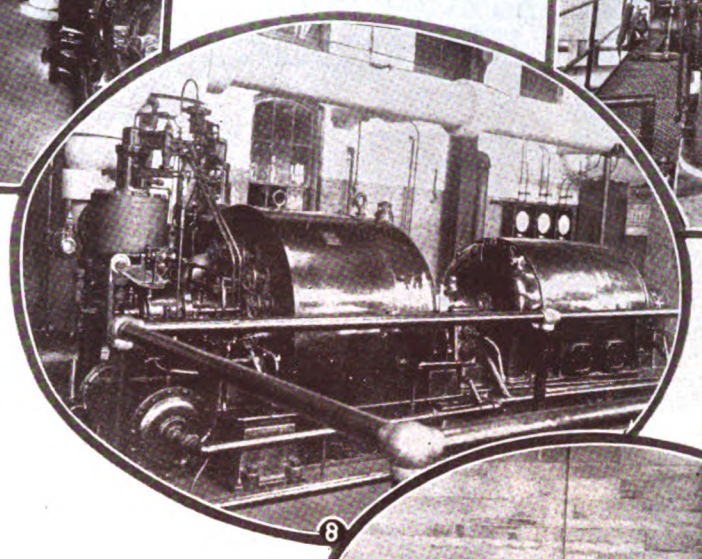


Fig. 7. Twenty-eight inches of vacuum means almost zero back pressure on this turbine. A perfect vacuum at sea level would read 29.92 inches on the mercury barometer.



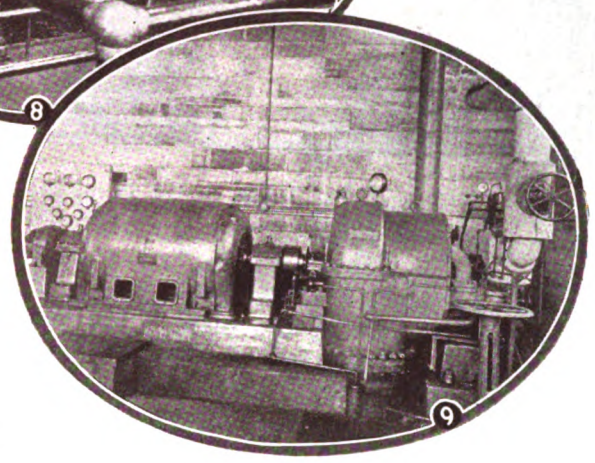


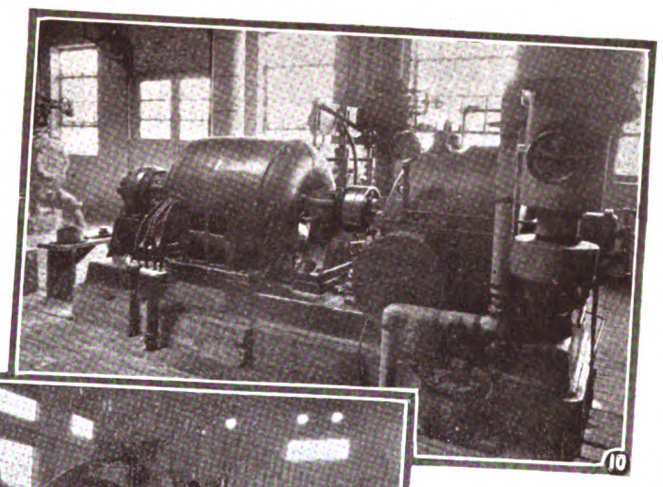
Fig. 9. A small turbine such as is adapted to industrial power service. This unit operates on 175 pounds pressure, 100 degrees superheat and at 27 inches vacuum. It drives a 500 kw. generator.

Fig. 10. Many industrial plants have found condensing turbine installations economical. The illustration shows a condensing turbo-generator set operating in the plant of the Sutherland Paper Company, Kalamazoo.

mospheric pressure. The principle involved is the sudden condensation of a large volume of steam as it is exhausted from the engine or turbine. In the liquid state the condensate occupies only 1/1700 of the original volume of the steam. If there is no inleakage of air, the space it formerly occupied remains absolutely empty and a vacuum is produced, tending to suck out the other exhaust steam from the prime mover into the unfilled space in the condenser.

The economy effected when operating a reciprocating engine on the condensing principle may be 20 to 30 per cent. greater than when operating non-condensing. In the case of steam turbines the gain in economy is even more.

Condensers are of two general classes, each of which is adapted to certain plant conditions. In each class there may be different types, according to variations in design to meet special operating conditions. Jet condensers are so called because the condensation of the steam is accomplished by mixing it thoroughly with a jet of cooling water, which is sprayed into the condenser. The water mixes with the steam and literally absorbs it. The mixture of cooling water and condensed steam is removed from the condenser by suitable means as fast as it accumulates.



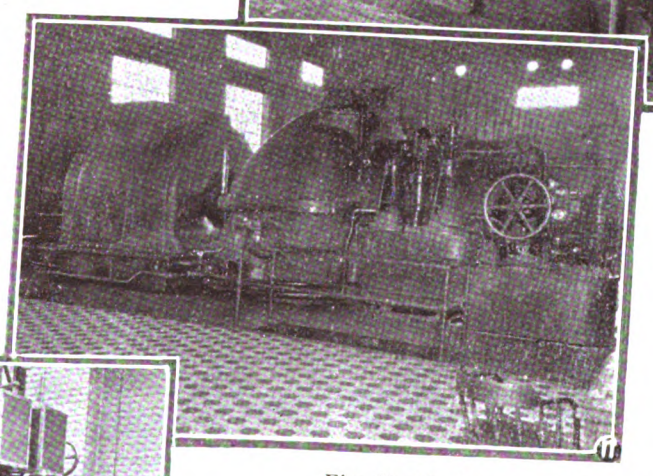


Fig. 11. Condensing turbines are especially economical in central stations where the units are large, and high superheat and vacuum are available.

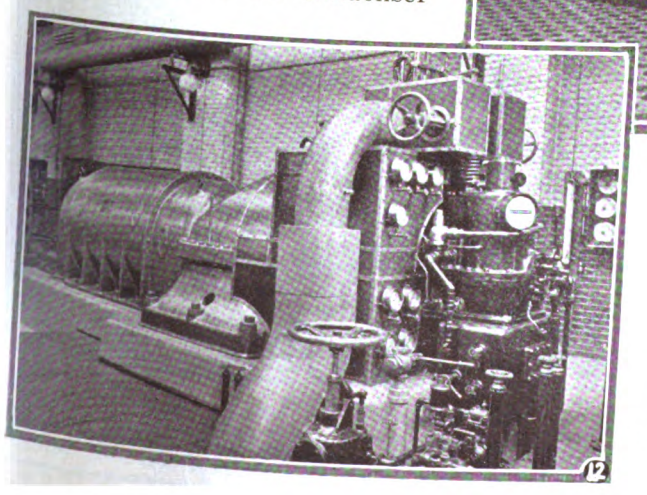


Fig. 12. Although the steam turbine may be less economical than the well designed Corliss or Unaflow engine when operating non-condensing, it is probably the most economical steam prime mover when operated in conjunction with an efficient condenser installation.

In the ordinary type of jet condenser the cooling water and condensed steam are removed by means of a vacuum pump. Such a pump is designed also to handle any air that is carried into the system by the cooling water. Some designs provide a removal pump to handle the water alone and an air pump for exhausting the air.

In the barometric jet condenser, the water is removed by the gravity action of the barometric column. No water pump is needed. A dry air pump is required, however, to remove any air that is caught in the system.

Ejector condensers provide for the removal of the water and air by the kinetic energy of water jets. High vacuum is secured without the use either of an air pump or removal pump.

The second general class of condensers includes those types which condense the exhaust steam by means of cooling water, without permitting them to mix. This type of condenser is known as the surface condenser and consists of a cylindrical shell or steam space, in which are placed a large number of small tubes.

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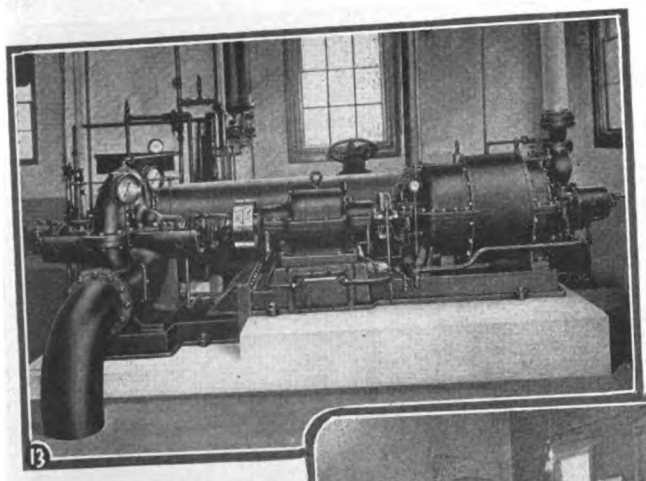


Fig. 13. A 220 hp. steam turbine of the condensing type operating at high speed and driving centrifugal pump through a suitable double helical reduction gear set. By properly designing the reduction set, both turbine and pump are made to operate at their most economical speeds.

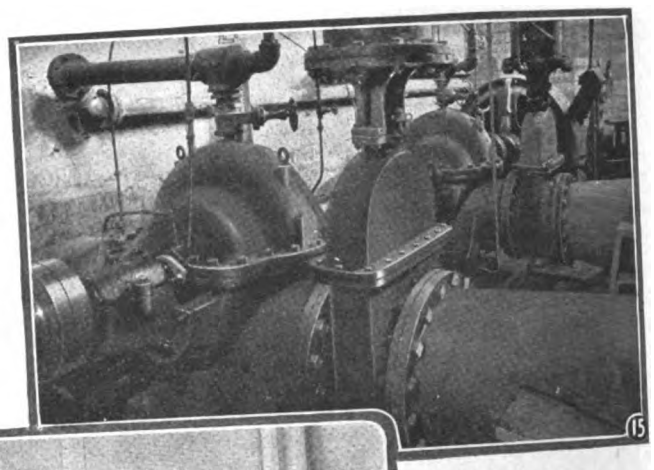


Fig. 15. Motor-driven circulating pumps which supply cooling water for condenser service at the plant of the Marquette Cement Company.

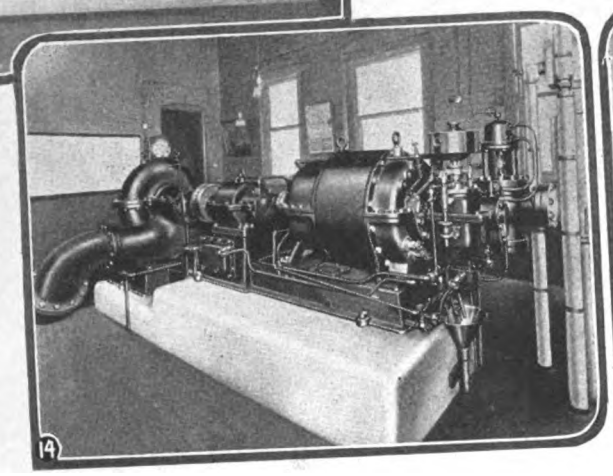


Fig. 14. Condensing steam turbines are especially adapted to centrifugal pump service. Constant speed and load make their operation most economical.

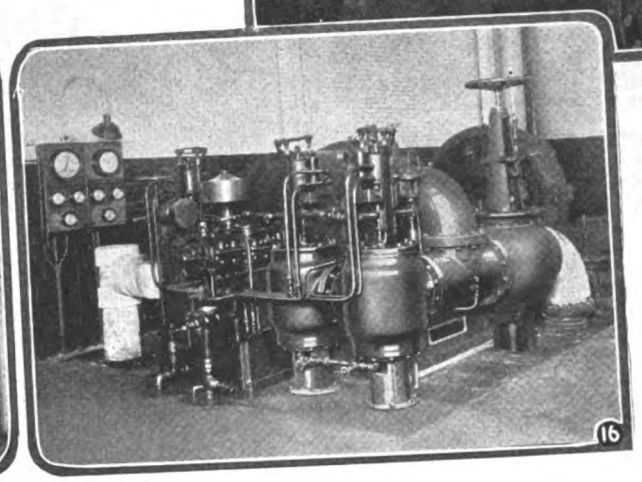


Fig. 16. Combined mixed flow and extraction turbine in a large industrial plant in New England. This type of turbine is especially adapted to industrial power service, since it permits the extraction or bleeding of low pressure steam from the turbine for heating and industrial purposes.

Cooling water is circulated through these tubes, absorbing heat from the steam much in the same way that water in a steam boiler absorbs heat from the furnace gases. The cooling of the exhaust steam causes condensation and a vacuum is produced. The condensate and entrained air must be removed by suitable pumps.

No matter what type of condenser is used, power of some sort is required for the removal of the water and air from the system, or for the circulation of the cooling water. Against the increased economy of the engine, therefore, must be charged the power required to operate the necessary condenser auxiliaries. As a general rule, these auxiliaries will use from 8 to 10 per cent. of the total steam used by the prime movers.

The load factor in each individual plant will determine to a large extent the degree of vacuum best suited to each installation. By load factor is meant the ratio of the actual yearly capacity developed by the prime movers, to the rated yearly capacity of the plant. The reason for this is that the fixed charges go on, whether the plant is running or not, while the gain due to a higher vacuum is realized only when the engines or turbines are operating.

In industrial plants the load factor varies considerably. As a general rule it is somewhat above 40 per cent. If the load factor is low (say 10 per cent. or under) the plant should undoubtedly be operated non-condensing, unless coal costs are exceedingly high. This is particularly true of plants where only one engine is in service. It may not be true, however, where more than one unit is used to carry the load. In the latter case, considerable economy may sometimes be effected by operating one or more of the units condensing. The engines carrying the steady day load should run condensing, while the unit carrying the peak should run non-condensing.

The selection of the proper condenser for any given plant will depend upon the conditions existing at the plant. Where there is a plentiful and cheap supply of good, cooling water, such as would be suitable for boiler feed purposes, some type of jet condenser might be found most desirable, providing a very high vacuum is not essential. Where overhead room permits the tall barometric type of condenser will perhaps give satisfactory service at a low first cost. Where cooling water is very dirty a siphon condenser may be required.

With the surface condenser any cooling water of reasonable quality may be used. The only restrictions are that it must not be so dirty as to seriously impair the efficiency of the cooling surfaces by coating the tubes with sediment and muck. With this type of condenser pure, softened boiler feed water is reclaimed from the condenser and

(*Continued on page 37*)

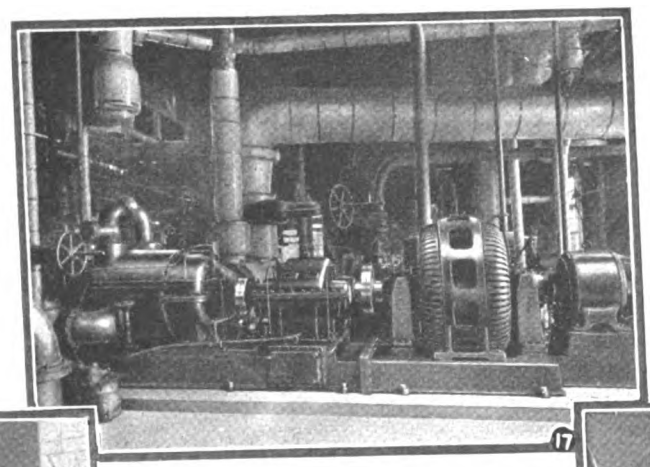


Fig. 17. High speed condensing steam turbine, driving an alternator through a reduction gear set.

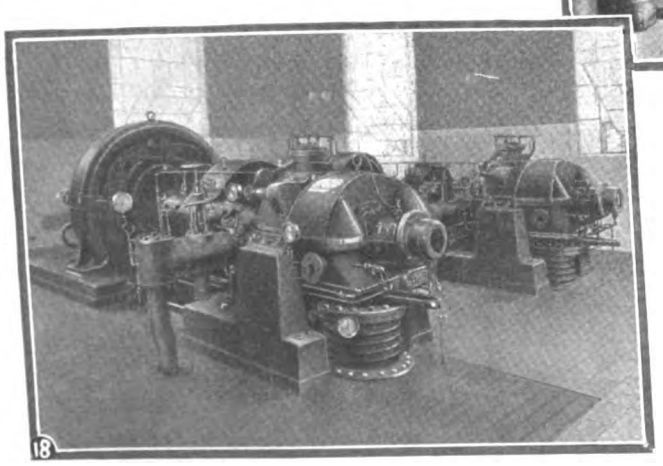


Fig. 18. Interior of an industrial power house, showing two condensing turbo-generator sets.

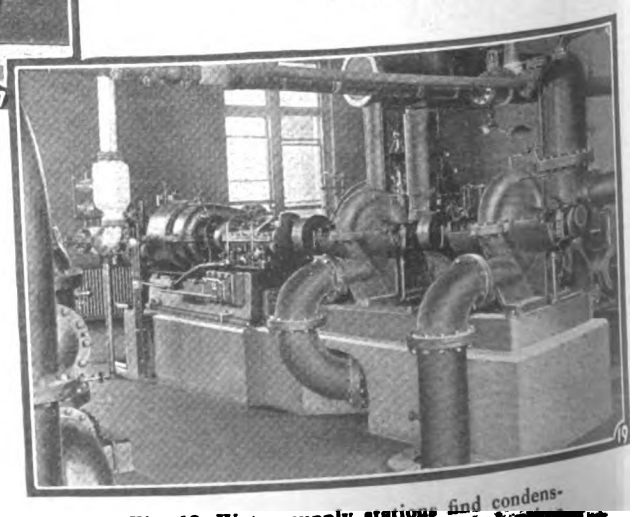


Fig. 19. Water supply stations find condensing steam turbines very economical prime movers in conjunction with centrifugal pumps.

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(1) *Glass encrusted with rust, carbon scale, etc., cannot be cleaned by ordinary methods.*

(2) *Yet when coated with Skybryte the crust of rust, soot and scale is almost instantly dissolved.*

(3) *Flush off with water, using hose where practical, the glass is clean and daylight enters.*

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SKYBRYTE has made possible the cleaning of the Skylights in the Riter-Conley Mfg. Co. plant after everything else had failed. Skybryte did the work well; at an amazing saving, and was easily used by an ordinary workman.

Cleans Regardless of Conditions

Regardless of how stubborn the crust of rust, dirt, soot and carbon scale on the glass in your plant Skybryte will clean it easily, quickly and splendidly.

Only Common Labor Necessary

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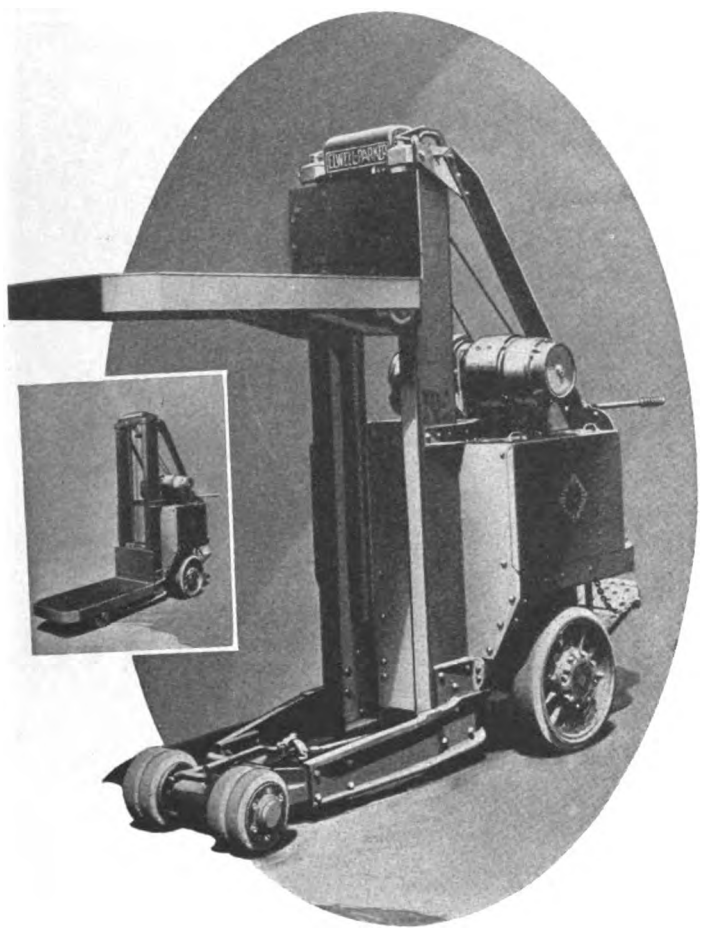
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Mechanical Handling and the Car Shortage

(*Continued from page 22*)

veyor, but after much experimental work, a special gravity conveyor, shown in figure 11, was designed and built, and is now operating in the plant of the Transfer Stained Shingle Co. Inc., North Tonawanda, N. Y.

With the conveyors as shown, and by using a curved section in the car, and another curved section at the pile, two men can easily do the work that three men did before the conveyors were installed, and when the pile of shingles to be loaded is in the center of the building, there is a greater saving.

Furthermore, the men can do their work more easily, speedier, and there is no carrying of the bundles of shingles.

The foregoing illustrations have shown equipment used for handling package or small bulk materials. It cannot, however, be overlooked that many conveyor installations such as that shown in figure 12, are really car loaders. Here, by the simple arrangement of an inclined belt conveyor, feeding to bifurcated spouts, considerable time and labor expense is saved in the loading of coke, both to gondola and box cars. The tracking arrangement under the spouts is of importance.

Figure 13 shows the loading of ice from pond directly to box cars for shipment to city storehouses or to railroad icehouses located elsewhere. Here speed of loading is an essential, and it will be noted that the engine is already coupled to the train, and that several cars are being loaded at once. The conveying equipment consists of simple drag chain conveyors, which pull the ice over slat runways.

When bulk materials are received in box cars, they present a difficult problem of unloading. To be the man operating a power shovel when unloading lime, as shown in figure 14, is not the most pleasant job, but the power shovel permits quicker unloading and causes less dust than would be the case if several men were shovelling with scoops at one time. It also speeds up the operation, thus making the time required for a man to be in this nauseating atmosphere shorter. The power shovel shown handles the material to the car doorway where it is dumped directly into the bucket elevator and raised to overhead storage tanks.

Smaller materials of this nature are being handled by means of pneumatic conveying systems, and it is hoped that as the development of these systems increases, it will be possible to handle large lump materials as rapidly and efficiently as they now handle the finer materials.

While several pieces of equipment have been shown for the direct operation of unloading, we wish to call attention to the power driven car puller, shown in figure 15. Power car pullers are of great assistance for shifting loaded or empty cars over track hoppers or to building doorways, etc., facilitating quick shifts at any time during the day, and not making them contingent upon the regular daily visit of the yard engine, as is the case in many instances. Moreover, figure 15 shows an elaborate conveying system and spouts for the handling of assorted coals.

Simple riggings are frequently large money savers as was the case of this car unloading equipment for handling road building materials. On such jobs, it is necessary to unload steadily so as to always have material in the small storage hopper to feed the trucks without delay.

This device in one day unloaded five carloads of materials with a total of 459½ tons. The job was accomplished in ten hours, which would make an average speed in handling of about 46 tons per hour, although one car containing 61.2 tons was unloaded in 43 minutes, which would be at the rate of 85.2 tons per hour. The labor costs of handling this material (gravel) was $8.00, or less than 2¢ per ton, to say nothing of the time saved by automatically loading the trucks.

Similar equipment is designed for handling coal in industrial plants. The bucket is self-dumping and is shown open, on the return run to the pit beneath the tracks for reloading.

To show the difference in the use of materials handling equipment in car unloading or loading, we direct attention to figures 19, 20 and 21, which show from a simple to a very elaborate method of unloading pig iron or metal. If the yard is small and tonnage handled is at the rate of

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about one car per day, a conical gravity conveyor as shown in figure 19 will greatly assist in the unloading of pig iron. If, however, there is other work about the plant yard of a miscellaneous nature as shown in figure 20, it would be advisable to install a boom crane equipped with magnet and operating on a tractor, so that it can travel about the yard without the necessity of running over definite lines of tracks. This sort of equipment when fitted with grab buckets and slings, can also be used for unloading heaving machinery, coal, etc. In the case of handling large sheet metal, I-beams and other shapes, scrap metal, pig iron, etc., the crane with double trolley operating on an overhead superstructure, and equipped with a magnet, hook, and slings will be found a great saver in time and labor on the unloading of cars and the distributing of the material to proper stock piles.

These illustrations may be said to go from the ridiculous to the sublime.

Locomotive cranes, as shown in figure 22, are common sights in the coal storage yards of large industrial plants. They have for years been the main medium for the loading and unloading of cars of bulk materials, such as coal, ore, stone, etc. Nothing need be said about the efficiency of this type of equipment, as it has been so long demonstrating its own value.

Some plants, because of their restricted space, are confronted with the problem of unloading coal from cars, and where it is impossible to install either a conveyor system or use the regular type of locomotive crane. The same is true on the handling of ashes. The cab-operated monorail telpher system, with grab bucket, as shown in figure 23, is operating under such conditions, and has been found very efficient as a car loading and unloading device.

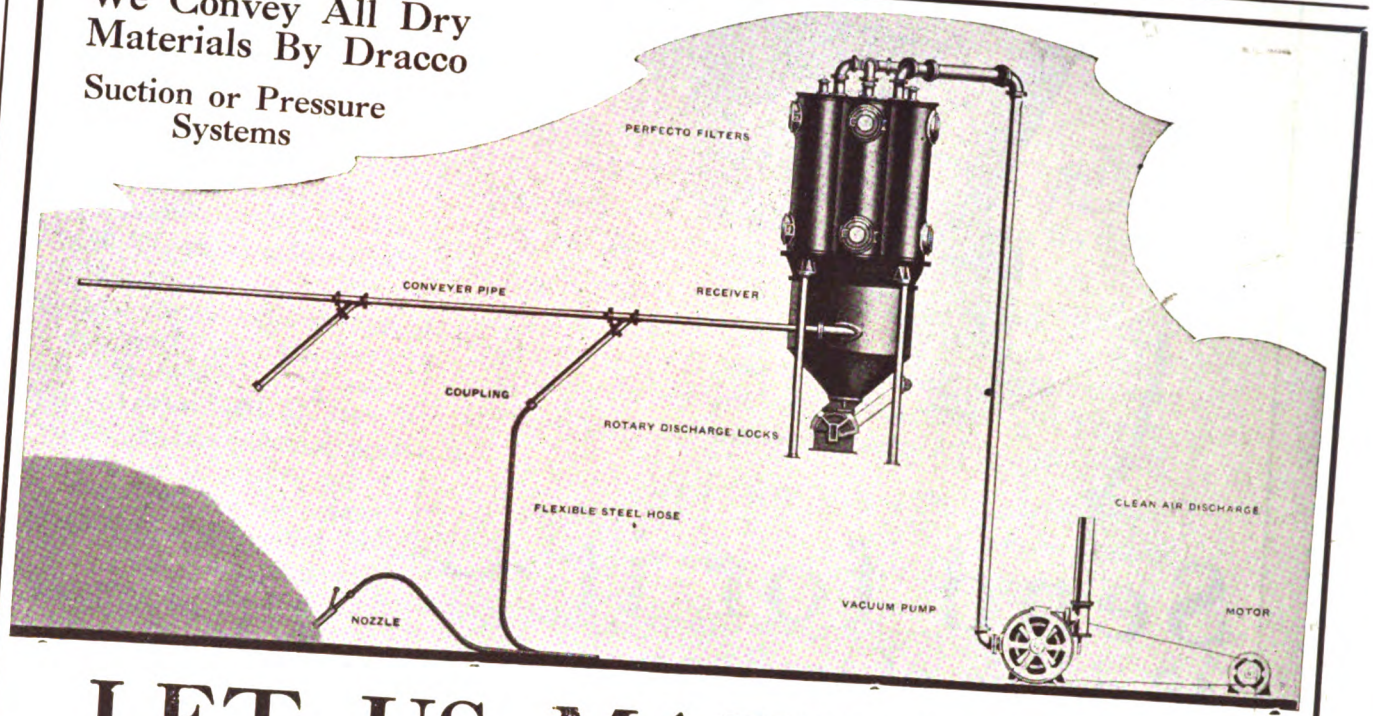
The illustrations shown so far cover the general run of small plant car loaders and unloaders, but large industrial plants and enterprises are confronted with what is known as large tonnage loading and unloading. These plants also require many cars each day. It is therefore more than essential that all cars be loaded and unloaded as quickly as possible.

One of the first demands for a large tonnage car loading device was in the coal fields for the loading of coal to box cars. One of the first loaders developed for this industry was the work of a man named Ramsay, who invented and manufactured such equipment during the years of 1890-1895. This loader consisted of a rocking arm or ram suspended in the center doorway of a box car. The coal was delivered by a gravity chute to the doorway and falling against this rocking arm was thrown from the center out toward the end of the car. It was fairly successful, as far as the reducing of hand labor necessary for the loading of cars was concerned, but the operation pounded and broke the coal so badly that the number of installations was limited.

About 1895 a Mr. H. Phillips and W. E. Hunt independently conceived the idea of developing a machine primarily for the loading of coal in box cars, which machine would take the coal from the chute at the center doorway of the car, and delivered the same back into the end without the breaking and crushing which was so detrimental to the

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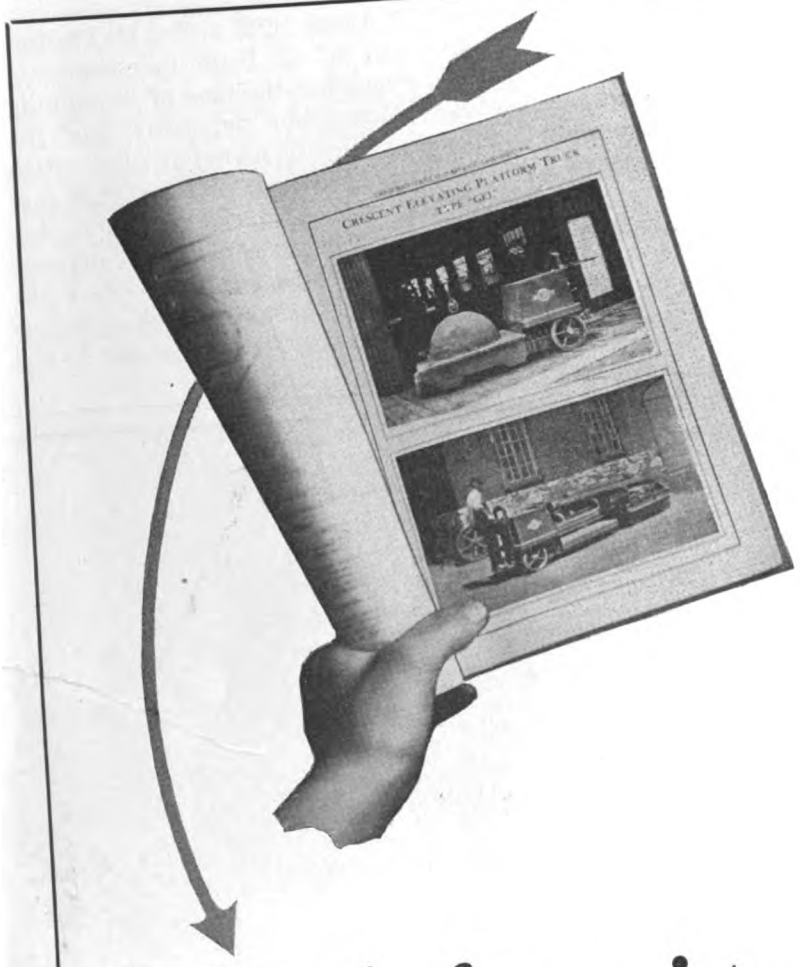
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THE DUST RECOVERING & CONVEYING CO.

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48 pages of transportation cost reducing facts.

Our new booklet, "Electric Industrial Trucks and Tractors," is for the managing executive whose material and goods transportation costs are too high. It is profusely illustrated with actual installation photographs, describes the entire line of Crescent trucks and will give you an idea of what can be done toward bringing carrying costs down to where they belong.

It has a message of interest for the man who moves

—heavy metal,
—unwieldy and bulky material,
—semi-finished or finished parts,
—boxes, barrels, crates, etc.,
—sand, stone, gravel, etc.,
—sugar, wheat, corn (sacks),

in fact anything that is liftable, is transportable on a Crescent truck.

The booklet tells how large industrials such as Bethlehem Shipbuilding Corporation, American Can Company, General Electric Company, Bush Terminal, have solved their carrying problems; it will tell you how to solve yours.

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CRESCENT
ELECTRIC TRUCKS & TRACTORS

sale of coal. These men soon learned of each other's efforts, and combining their ideas, manufactured the first car loader that was ever offered to the coal trade for the loading of coal into box cars, where consideration was given to the material handling. This first loader was installed at one of the coal mines in Iowa, and, needless to say, it was only a partial success, as there were many mechanical details that needed correction.

It was, however, of a general design that was developed rapidly, and the two first successful machines were installed a year or so prior to 1900, one in the State of West Virginia, and one in the State of Wyoming, and this same type of machine is still being manufactured. This loader was known as the pusher type box car loader, and was mounted on a stationary foundation which was built beside the loading track in line with the screens and delivery chute. This machine consisted in brief of a heavy I-beam frame, mounted on rollers attached to other I-beams, which are in turn anchored to the foundation.

Since that time, however, it has been necessary to make this equipment of a portable nature, and this is the type of loader shown in figures 24 and 25. Figure 24 shows a portable loader inserted within the car and handling lump sulphur, while figure 25 shows the same style of portable machine withdrawn from the car and a clear view of the working mechanism, which operates to place the material at the extreme ends of the box car. On the end of the frame, nearest the car, is located a heavy circular steel casting operating on large ball bearings, which permits it to be easily turned. In this circular steel casting is mounted a hopper, which is the real loading device.

This hopper is trough shaped and curved from end to end, in order that the end of the hopper in the center of the car is low enough to be under the chute and the other end of the hopper, which extends out into the end of the car, should be high enough to load the cars to capacity. Inside this hopper is what is styled a pusher, which, when the hopper has been filled with material, travels through the hopper, pushing the materials to the end of the car. A very ingenious ball and socket connection carries the power from the main power shaft of the engine or motor, as the case may be, to the hopper, permitting the hopper and pusher to operate at any angle to which the hopper may be turned.

When being placed in operation from its position at rest outside the car, the framework at right angles to the tracks, upon which the hopper is mounted, moves forward. The hopper is turned at an angle at the start, and as the main frame continues its forward movement, the hopper is swung around parallel to the length of the car. As the dumping of the material commences, the entire hopper travels forward toward one end of the car. In this way the hopper is entirely filled with material and the pusher comes into action with the hopper held stationary. The pusher travels out toward the end carrying the material ahead of it, and in to the end of the car. When the pusher reaches the end of the car it automatically trips the hopper, which then again travels past the chute being filled with material, and the pusher again deposits this material in the opposite end of the car. Thus practically continuous movement of the hopper and the pusher, from one end of the car to the other, alternately depositing at each end, takes place, the loading continues without interruption until the car has been loaded, at which time the loader can be quickly removed from the car, reversely as described for entering. If desired, the doorway of the car can then be filled up by dumping direct from the feeding chute.

A different type of car loader on the same principles, but using a belt conveyor instead of the traveling hopper, is shown in figure 26. When unloading cars the problem is somewhat different, and figure 27 shows a rotary car dumper, which is capable of handling one loaded car at a time. This dumper rotates, spilling the contents of the car directly to hoppers beneath the tracks. The empty car is then removed and another full one put in its place. This type of equipment is now being used extensively in large public service plants.

Figures 28 and 29 illustrate, respectively, the end tip and the side tip of a car unloader. It is possible with this machine to unload a car in about five minutes time. It is especially useful at grain elevators, in fact, in the unloading of any bulk material

(*Continued on page 35*)

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How much money would *your* plant save if one man hauled 16 loads at a time?

Great long caravans of heavily loaded Stuebing trucks may be seen almost any time of day in the prominent plant where this view was taken.

If it were more economical to do the job any other way, or with any other trucks, Stuebings, in trailer formation, would not be used, for there is no sentiment in profit-making!

There are hundreds of plants in which this same system can be used with equal economy, efficiency and all-round satisfaction.

Think, for instance, of *your* conditions. Are you trying to achieve results with trucks *other* than Stuebings in the face of an almost universal preference for Stuebings among the nation's greatest industries?

Almost every present user of Stuebing Lift Trucks "graduated," just as you will, after a period of experiments and costly experience.

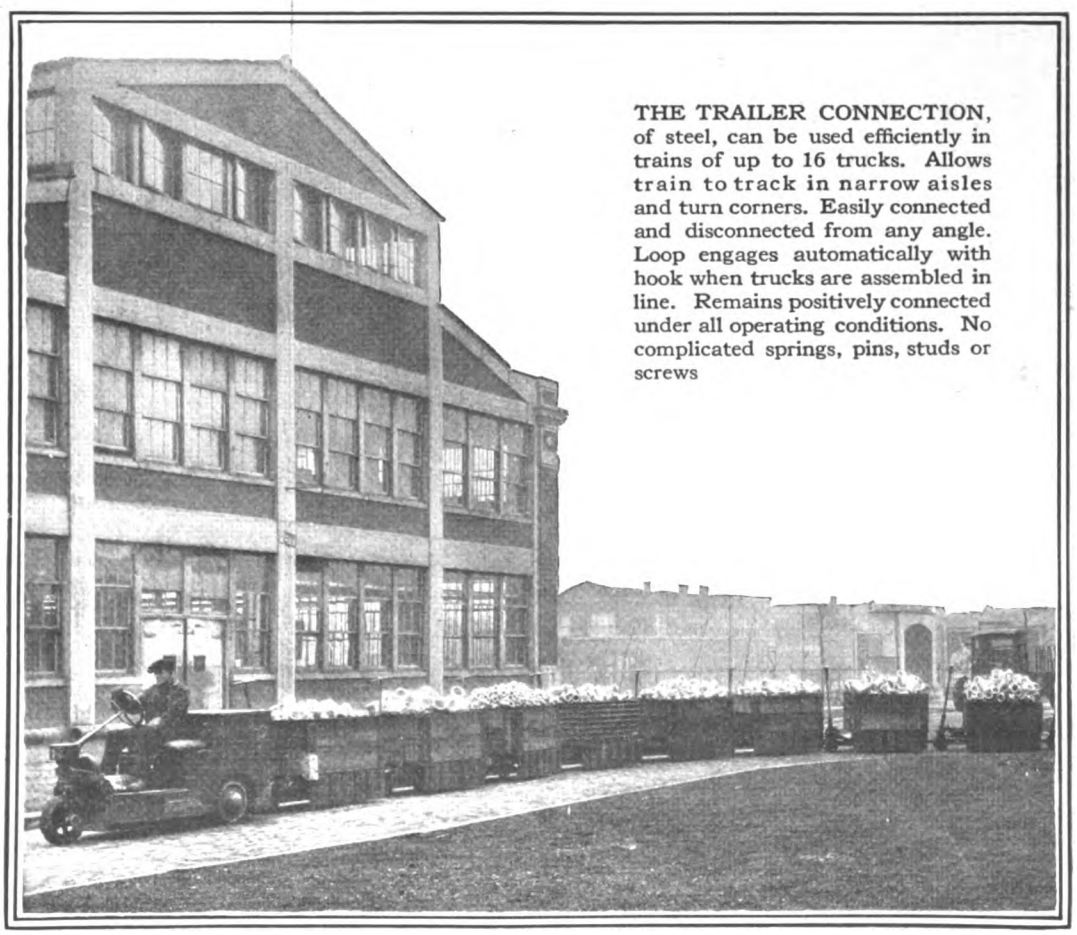
Are you figuring your hauling costs on a one-man-per-load basis? Then, look again at the view below. If you can use the lift truck trailer system picture what it would save *you* in labor costs.

And, in addition to the saving of labor in *hauling*, you can include the very tangible profit gained from the saving of labor in *handling*, for Stuebings *eliminate the re-handling* of every load they haul.

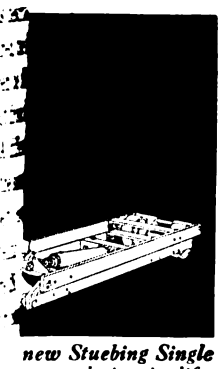
You can figure these savings in dollars and cents when the efficiency and economy of the Stuebing System is *definitely applied to your own material handling problems*.

Let us arrange with a Stuebing representative to do this. He will lay before you the facts and figures which will quickly enable you to determine how profitably you can use Stuebing Lift Trucks. Write us today for a copy of our new 36-page catalog.

THE STUEBING TRUCK COMPANY
Cincinnati, Ohio — Cornwall, Ontario
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THE TRAILER CONNECTION, of steel, can be used efficiently in trains of up to 16 trucks. Allows train to track in narrow aisles and turn corners. Easily connected and disconnected from any angle. Loop engages automatically with hook when trucks are assembled in line. Remains positively connected under all operating conditions. No complicated springs, pins, studs or screws



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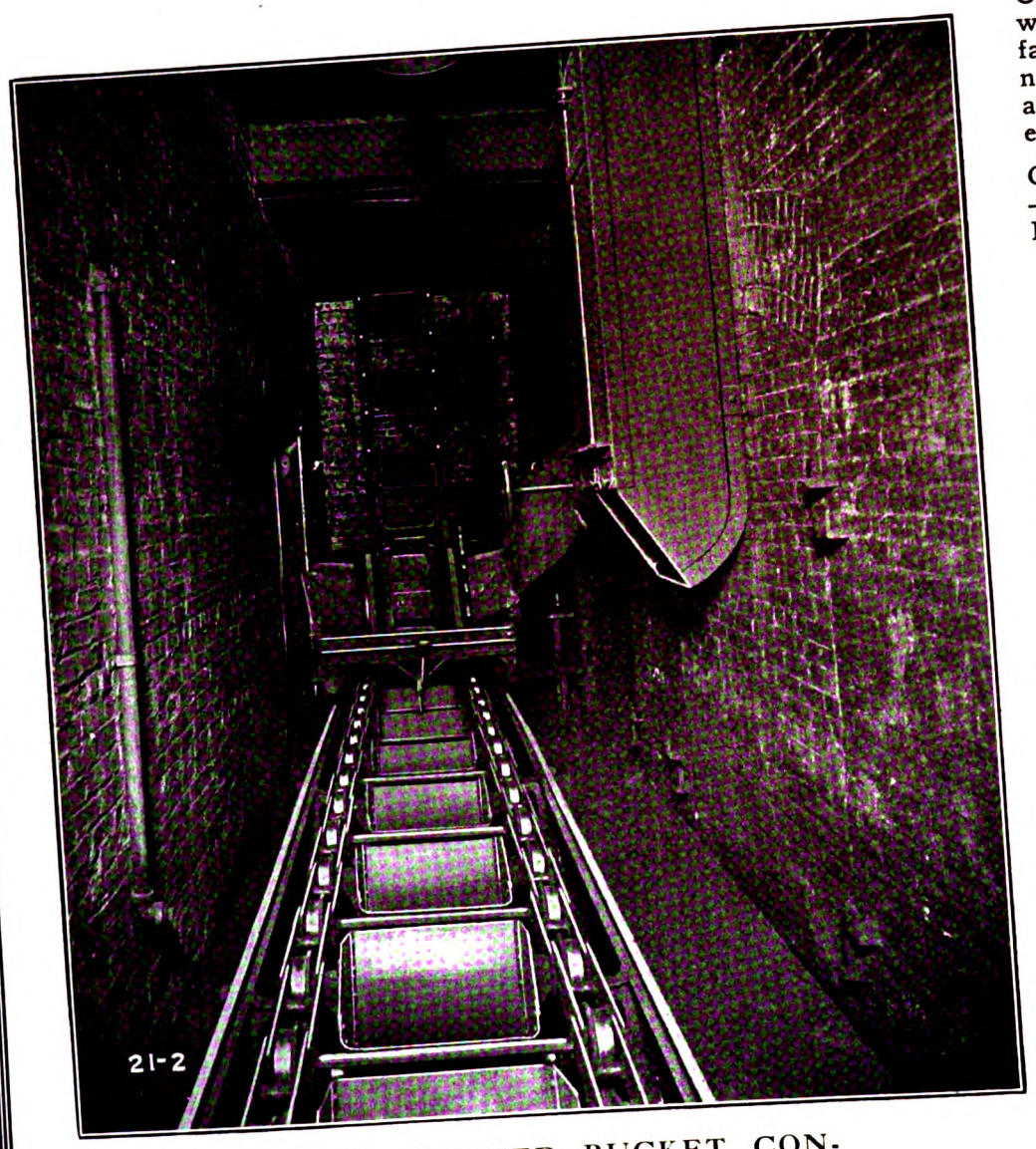
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10,000 Acres of Coal Land For One Ear of Corn Yearly



HUNT PIVOTED BUCKET CONVEYOR SHOWING MOVABLE FILLER

The buckets are loaded by a filler of the revolving drum type, which is driven from the conveyor chain through a wheel designed to properly engage in the links of the chain. The filler moves in perfect synchronism with the conveyor and gives an equal charge to each bucket, filling each bucket to capacity without spilling the material over the edges or between the buckets. It furthermore prevents dust and grit from getting into the working parts of the conveyor.

The filler can be set up at any point of the run where it is desired to fill the buckets; can be moved from place to place as necessary.

One hundred and six years ago, Josiah White, who operated a small rolling mill for the manufacture of wire and nails, at Schuylkill Falls, near Philadelphia, penetrated the wilderness around Summit Hill, Mauch Chunk, Penna., to examine the coal deposits existing there.

Quoting from an article by Henry M. Propper, —in a recent number of the New York Tribune Magazine,—Mr. White in his diary relates:—

> "—We at once set about to get a lease of 20 years on the Lehigh Mine Co.'s Coal Lands of 10,000 acres *for one ear of corn a year, if demanded.*—"

Nevertheless, Mr. White and his partner, Erskine Hazard, had innumerable difficulties in disposing of their "rocks that burn," (in the year 1817) at $8.40 a gross ton. People refused to buy at any price.

The greatest difficulty encountered was transportation from mine to market, since there were no roads through the almost impenetrable wilderness, and the rock-strewn shallows of the Lehigh River proved almost as insurmountable a barrier. However, they finally succeeded and laid the foundation of a great industry.

As in the early days mentioned in the foregoing, the transportation of coal to the consumer has borne the brunt of the expense and, prior to the past half century, the method of its distribution from the time of its receipt at the plant had also been fraught with many difficulties, was time consuming, laborious and expensive.

Then, in 1872, C. W. Hunt devised and built machinery which revolutionized the handling and rehandling of coal and ashes. Formerly, where muscle and brawn performed this task, Hunt Cost-Cutting Equipment took over the burden and made light work of it; made it less costly, made its action speedier.

For over half a century, Hunt Cost-Cutting Equipment has been helping each industry to produce profitably by reducing the coal and ashes and bulk materials handling expense; and Hunt Engineers have given of their best in planning a system to carry out to a satisfactory conclusion, the ideas engendered by 52 years' experience in their specialized field of materials handling. Call on them for assistance at any time; the sooner the better for you.

C. W. HUNT CO., Inc.

West New Brighton, New York City

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431 South Dearborn Street, Chicago, Ill.

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141 Milk Street, Boston 9, Mass.

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(*Continued from page 32*)

where a large number of cars per day must be unloaded.

The car to be unloaded is run on to the tipping cradle when it is in a horizontal position, gripping devices are then mechanically raised, which catch, center, and hold the car rigidly in position, and a chute is moved against the car and car door openers take hold of the door. The operator starts the motor, which tilts the deck and tips the car to the side to an angle of from 15 to 24 degrees. As the car tips to the side, the grain door or boards are removed, permitting an opening under the same through which the material to be unloaded can flow. At the same time, the operator starts another motor, which tips the cradle to one end, and the material in the center of the car immediately flows out through the unloader chute and down into a hopper to some type of conveying system, and as the tipping continues, the material at the high end of the car flows out entirely. It can readily be seen that the end tip gives the material the momentum, and the side tip directs the flow so that it is carried to the side door through which it flows.

The first end is quickly unloaded, the cradle is then returned to the horizontal and tipped to the opposite end. This unloads practically all the material in the second tip, except a small portion, which will have run past the car door and the third tip entirely removes this last material.

The cradle and the tilting deck are then returned to the horizontal, the supporting posts swung under the cradle ends, the chute and the car door openers removed, the grip released from the car and the car removed, giving place to another loaded car. A full grain car can be unloaded in from five to nine minutes time, depending on the facilities of getting the cars to the unloader and removing the empties therefrom.

It is not only industrial plants that are giving thought to the unloading of cars, but the railroads themselves are locating cranes as shown in figure 30 at most of their freight terminals to assist in unloading heavy equipment direct from cars to consignees' motor trucks, wagons, etc.

If everyone will coöperate in the unloading and loading of cars at all times, it will do much to eliminate the hue and cry of car shortages.

In addition, loaders and unloaders have many advantages:

They reduce labor expense and permit men to be released for more productive labor. Many men are now required to unload box cars at large elevators, terminals and transfer plants, etc., which could be just as well taken care of by mechanical devices.

They save track unloading space, buildings and equipment. In order to unload many cars per day, it is necessary to have a number of unloading pits, also a great amount of tools and equipment. This requires an expensive track arrangement, and expensive buildings to cover these loading pits. Mechanical loaders operate over one pit on one track and with very small building for covering. A considerable initial investment, large maintenance expense and valuable space can thus be saved.

They permit continuous operation. This is made possible by the installation of mechanical loaders and unloaders and the plant executive is no longer de-

The Turn of the Tide in Motor Hauling!

Demands of Economy, Efficiency and Time-Saving Have Forced Tractor-Trailer Method to the Front

The Year 1923 More Than Doubled the Number of Users of

LAPEER SEMI-TRAILERS

It has been demonstrated that one tractor and three Lapeer Semi-Trailers can do the same amount of work performed by three motor trucks, within the same length of time, at ONE-THIRD THE COST OF OPERATION and with ONE-HALF THE INVESTMENT in equipment.

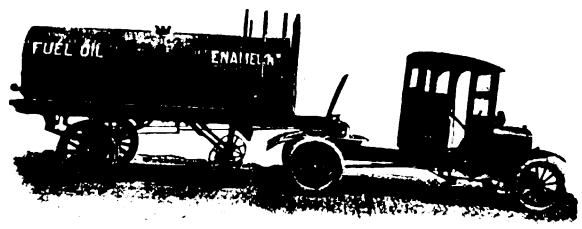
Motor Capacity Trebled

Ton-Mile Cost Cut to One-Third

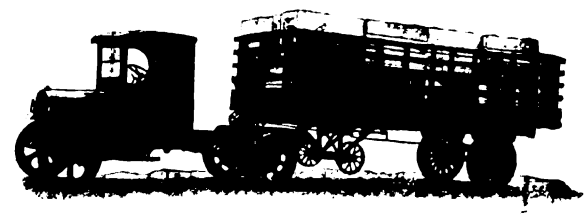


No Idle Motor During Loading and Unloading

One-Half the Investment



Any Kind of Body — Any Kind of Hauling



A STEP BEYOND THE TRUCK

Here Are the Distinctive Lapeer Features:

COUPLING—The Lapeer Semi-Trailer is coupled or uncoupled automatically and instantaneously, without the use of jacks or other devices, the operation being controlled by the tractor chauffeur from his cab without leaving his seat.

BRAKING—The brakes upon the trailer apply automatically when the trailer is uncoupled, making it unnecessary to block the wheels. The brakes are automatically released by the coupling operation. The trailer brakes also apply automatically, when descending a grade, to prevent the trailer from over-riding the tractor.

CONTROL—The tractor driver has complete and accurate control of the trailer, both forward and in reverse.

MOBILITY—The Lapeer Semi-Trailer, when detached, is a complete vehicle, the front support wheels enabling easy moving about by hand or otherwise.

Manufactured by

LAPEER TRAILER CORPORATION

LAPEER, MICHIGAN

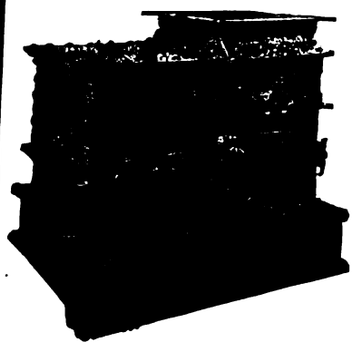
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Write for Lapeer Folder I-101 and list of Lapeer users.

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PENNSYLVANIA

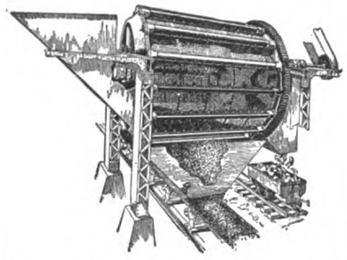


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39 Sizes

For Coal, Lime, Limestone, Shale, etc.

(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
(c) Oversize Bearings
(d) Patented Tramp Iron Separator
(e) Manganese Steel Wear Parts



BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY

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pendent upon unreliable labor.

They release cars and save demurrage. At every plant delays have many times been made by failing to load or unload within the allotted free time. This results in serious handicap to railroad management, to the public who needs the cars, and is a direct financial loss through the payment of demurrage to the owners of the plant.

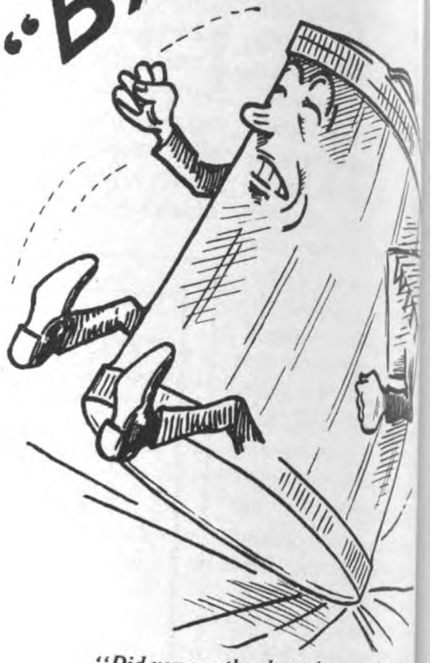
They simplify conveyor systems. With a multiplicity of unloading pits, a complicated conveyor system would be necessary. Such systems are extremely expensive, and cost money to maintain and operate. They also require considerable room. Why not eliminate these many pits, complicated conveying systems and unload into one pit and on to one conveyor.

There are many other advantages too numerous to mention, but which have undoubtedly presented themselves to the readers. Many plants have heeded the advice of these pages, and have installed conveying systems, lift truck methods and monorails and telphers, for handling materials within the plants, and they should therefore direct attention to the loading and unloading of cars, so that there will not be a choke point in the receiving of raw materials and the shipping of finished products.

"In an advancing social order, power must be both cheap and plentiful. Therefore every possible economy must be practiced. This implies the conception of a state-wide (and ultimately a nation-wide) reservoir or pool of power into which we may pour energy from whatever source, and from which storage we may take out energy to meet widely diversified scattered needs.

"Giant power means cutting out waste. The burning of raw coal in power plants and on our railroads has come to be recognized as waste, involving as it does, the loss of by-products, such as ammonia, needed for fertilizer on the farm; tar for road-building, and other hydro-carbons useful as dyestuffs and otherwise in the industries. If these economies can be realized through building large scale by-product distillation and power plants at the mines, it will mean cheaper power because of the reduction in the cost of fuel."—*Governor Pinchot of Pennsylvania.*

"BANG!"



"Did you see the abuse that man handed me? Go to it, old boy, you may shake up my contents but you can't hurt me! I'm built for rough usage."

WITT CORRUGATED CANS AND PAILS

because of their remarkable durability, will insure efficiency and dependability in the handling of your oils, small parts, rubbish, etc. Their rugged construction—deeply corrugated sheet steel held firm and rigid by heavy iron bands at top and bottom—enables them to withstand unusual and severe service. Their water-tight seams and close fitting lids are protection against the fire hazard.

For oil-soaked rags and inflammable liquids, a special can—Witt Corrugated Oily-Waste Can—bears the label of approval of the Underwriters' Laboratories, Inc. The use of this can will reduce your insurance premium and more than pay for themselves.

If your mill supply house does not handle WITT Corrugated Cans and Pails, write us. There is a type and size for every purpose.



WITT CORRUGATED Substantial Sanitary Safe

The WITT CORNICE CO.
CINCINNATI, OHIO

THE YELLOW LABEL MEANS QUALITY

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Making Steam Do Double Duty

(*Continued from page 28*)

needs only to have the lubricating oil extracted before it is again ready for introduction into the boilers.

Where high vacuum is essential, such as in steam turbine operation, the surface condenser is generally selected for the service, although the barometric condenser may also give excellent results.

The condensing engine or turbine can be used only where a sufficient quantity of suitable water is available at a reasonable cost. In some instances it may be necessary to utilize the same cooling water over and over again, in order to avoid excessive water bills. In such cases an outdoor reservoir or pond may be provided and suitable means installed for reducing the temperature of the hot circulating water as it comes from the condenser.

Where only a cooling pond is provided, the water may be cooled partly by the radiation and conduction of the heat from it, but the chief cooling agent is the evaporation of some of the water, by which action heat is absorbed from the balance of the water in the pond. Where engines operate only twelve hours a day, the pond should provide 105 square feet of surface water for every horsepower. The depth should be such as to give a tank capacity of 300 cubic feet per horsepower.

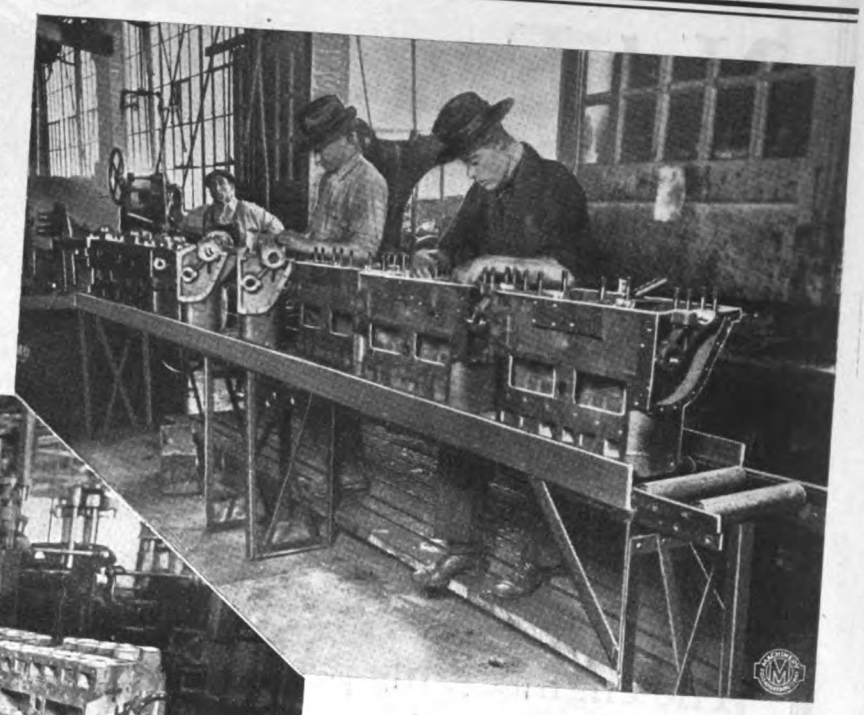
To hasten evaporation, thereby reducing the size of the pond required, the hot circulating water from the condenser may be distributed through a network of pipes to a multitude of spray nozzles, from which it falls to the pond in a spray.

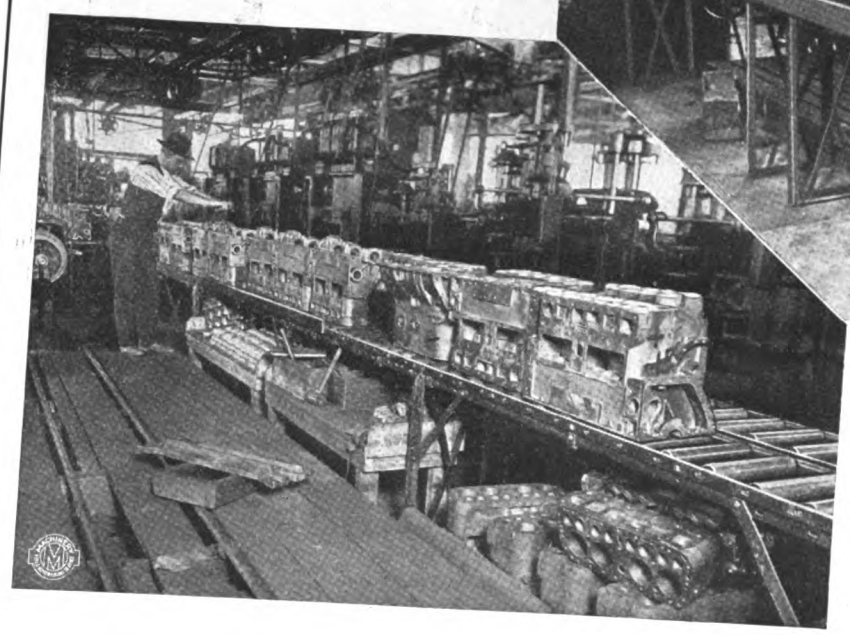
Where ground space is not available for the use of a spray pond, a cooling tower, consisting of a wooden or sheet iron housing, open at top and bottom, may be so arranged that the hot circulating water can be pumped to the top and distributed along the tower in such a manner that it falls in thin sheets or sprays into a receiving tank at the bottom. A current of air is drawn through the tower by natural draft, or forced through by suitable fan or blower. This air current cools the water by the evaporation principle and the heat absorbed from the water is carried out of the tower with the air.

With the best types of cooling towers the temperature of the cooling water may be reduced, under favorable conditions, from 40 to 50 degrees, with a loss of only 3 or 4 per cent. of the water passing through the tower. The power used by the fan is not more than 1 or 2 per cent. of the total power developed by the prime movers. Such a tower may be located on the top of the building and may be any reasonable distance from the condenser itself.

Where the heat in the exhaust steam from the engines or turbines can be entirely used for heating and industrial purposes, condensing operation would not be economical. If the prime movers were to be operated condensing under such conditions, it would be necessary to supply live steam from the boilers for the heating service; whereas, if

Handling Motors Without Power Cost===





Would It Save For You?

A FAMOUS automobile manufacturer moves crank cases through his machine shop by the cost-free force of gravity. His conveying cost is nil. A sugar refiner transports sugar from the warehouse to cars by gravity. His power cost is nothing.

A hundred manufacturers, large and small, move varied materials and products on Mathews Gravity Conveyers. So they eliminate truckers' wages, trucking congestion, confusion at elevators and similar, unnecessary costs.

In *your* plant these varied experiences may suggest a considerable saving. A 50 to 75% reduction would not be unusual.

The labor saving advantage alone is worth an investigation.

Your products may be small or bulky. You may move them once or many times in your plant. Yet there is a Mathews Gravity Conveyer that will put the costless power of gravity at work on your material handling.

A Mathews Engineer will be glad to study your requirements with you, and point out any opportunities where savings in your transportation may be made. Or, if you wish, we will send the Mathews catalog showing many instances of cost reductions. Write us.

MATHEWS GRAVITY CARRIER CO.
157 Tenth Street **Ellwood City, Penn.**

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they were operated non-condensing, and the exhaust steam used for heating, the demand for live steam for industrial purposes could be greatly reduced, if not entirely eliminated, and a material saving could be effected.

In a large manufacturing plant in New England a 1,000 kilowatt turbine was recently installed to assist in carrying the plant load. Variations in power, exhaust steam and hot water requirements in the plants made necessary a careful study of the operating conditions, with a view to selecting the proper type of turbine to satisfy these requirements in the most economical manner.

An unusually economical arrangement was finally determined upon by the selection of a turbine that would operate as a straight condensing unit when the exhaust steam from other units was sufficient for the demands of the low pressure line. When there was a deficiency in this line, the turbine would operate non-condensing, delivering its steam to the low pressure steam main. If only a fraction of the turbine steam was required to make up this deficiency, sufficient steam could be bled from one of the intermediate stages to supply this demand, the balance of the steam passing through the low pressure end of the turbine into the condenser.

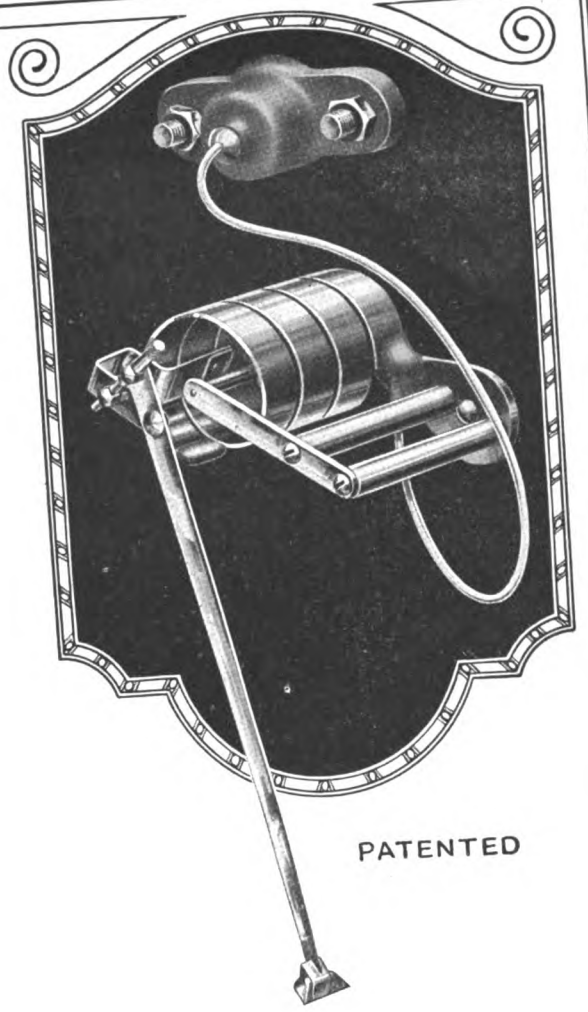
This turbine could also operate as a mixed flow turbine, receiving both high pressure and low pressure steam from the exhaust of the reciprocating engines, when there was a small surplus of steam in the low pressure main. If the surplus of low pressure steam was sufficient the turbine would operate as a straight low pressure turbine. In both these cases the exhaust of the turbine went to the condenser.

The change from one condition to another was made automatically in response to the pressure existing in the low pressure main.

This splendid example of low pressure steam economy in connection with the condensing operation of steam engines and turbines is cited not because it is at all unusual, but because it is typical of what may be accomplished in the way of economy in the use of steam and in realizing all the usefulness available in exhaust steam, thereby attaining high operating economy and low power costs. Similar conditions are found in nearly every industrial plant and can be met in the same intelligent way.

The extent to which industrial life in Germany has been coordinated, it is stated, is shown by the fact that more than seven hundred German national standards have been adopted. This includes only those in which several different industries are concerned, and which are approved by the central national body. These include fundamental engineering standards as: standard diameters, tapers, sizes of keys, threads, fits, etc.; materials, tools, measuring instruments and gages; machine parts, including handles, ball and journal bearings, etc.; gears, and sizes of paper.

Not Exactly A Parlor Story



PATENTED

A recording instrument salesman wound up his long eulogy by exclaiming, "Look at the brains in that instrument."

The engineer, his prospect, replied, "Sure, it has brains. But the Foxboro Recorder has brains and "*guts.*"

What this engineer meant was that the Foxboro Improved Helical Tube Movement is permanent in calibration.

It has strength. Not the clumsy strength of excess metal, but the sinuous strength of virgin ingot metal, drawn, shaped and tempered by a secret process discovered by Foxboro engineers 2½ years ago.

It can be used constantly at maximum chart range. No limited "working ranges" specified.

It positively will not fatigue, set, split, leak or crack even when subjected to excess pressures that carry the pen way beyond the outer edge of the chart.

The pen arm has a definite axis of rotation. Pens always follow time arcs of charts.

Accuracy within less than 1% of total scale reading is guaranteed. No adjustments are necessary.

The Foxboro Improved Helical Tube Movement frees you from the limitations of obsolete principles of recording instrument construction.

Write for Bulletin A154.

THE FOXBORO CO., INC.

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New York Chicago Boston Philadelphia Pittsburgh Cleveland Rochester
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A trial will, we believe, convince you that you too can benefit by the use of Rectigraph Products.

Send us your order for a roll of Rectigraph Paper, spooled to fit your photo apparatus so you can judge of its merits.

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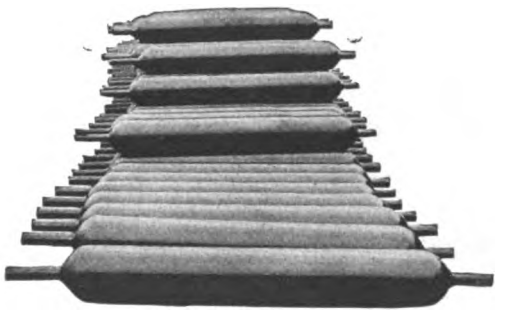
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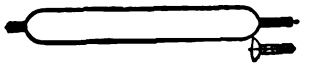


SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Whenever rollers are used, Conveying Systems, Steel Mill Tables and the like, maximum neck-strength is required because here the strain is most severe. Wharton rollers are made in one piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained.

Yet, because they are hollow they are light in weight—saving in freight—easy to handle—lower power cost. Built only on order to meet customers' requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large-sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.



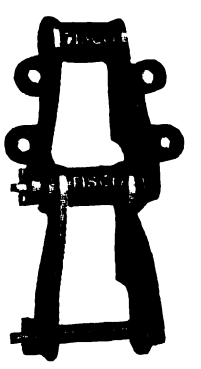
Cross-Section Showing Hollow Construction

Wm. Wharton Jr. & Co., Inc.

(Founded 1859)

30 Church Street, New York, U. S. A.

Cable, Whilwharton, New York





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Recognized as the standard in manganese steel. Records of its performance show durability from five to fifteen times as long as malleable iron.

Bulletin 113-J embraces complete description of these products with illustrations of the various types.

Taylor-Wharton Iron & Steel Co.,

High Bridge, N. J.

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The Oxy-Acetylene Flame in Industry

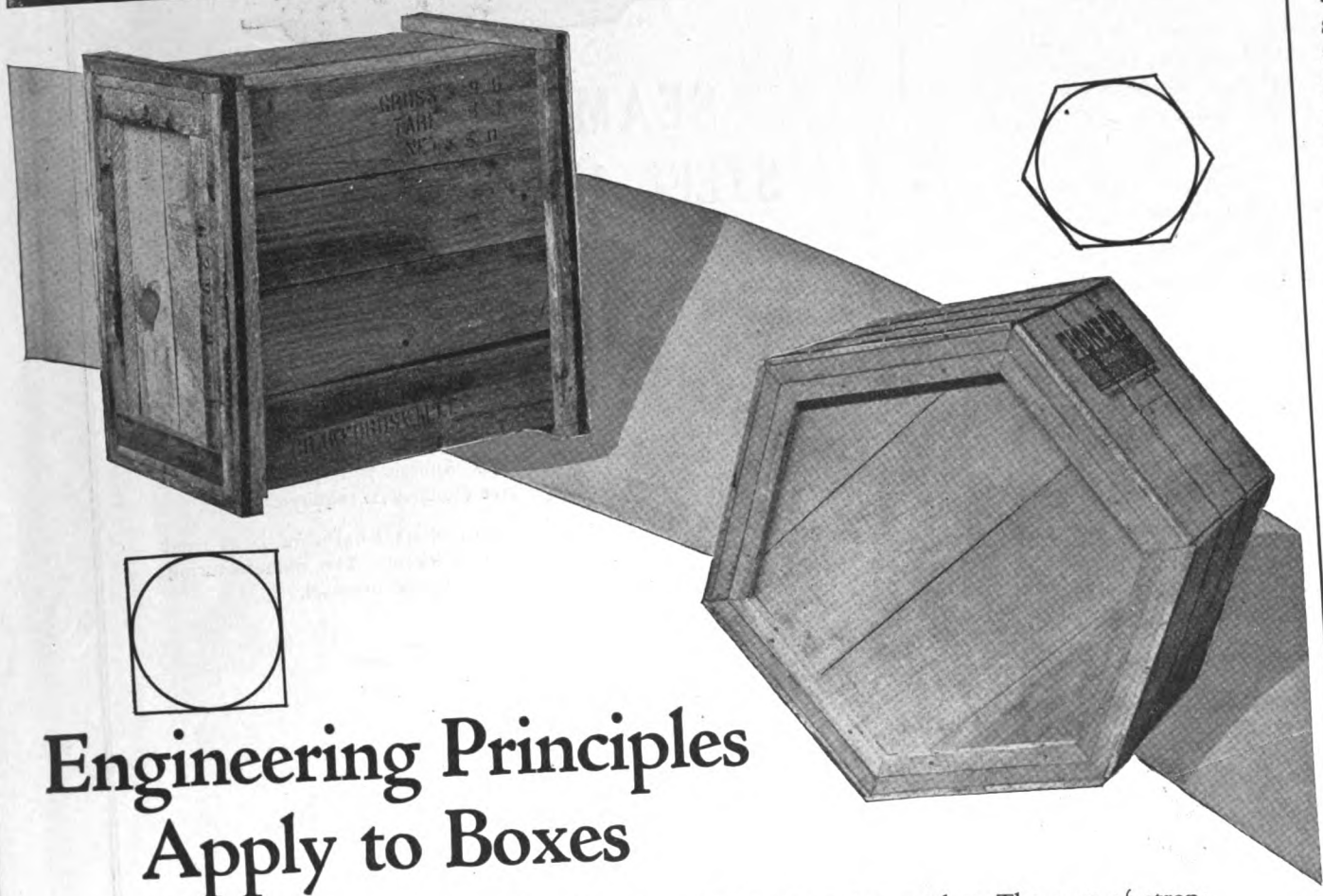
(*Continued from page 25*)

made to unite by the application of the hammer. The temperature is much below the melting point and the hammer, or an equivalent, is essential. In the processes of welding with gas, however, part, if not all, of the metal immediately involved is brought to the melting point, and the hammer may be dispensed with. This will become clear in what follows. Let us assume that it is desired to unite two one-inch steel plates edge to edge. The orthodox method requires that the edges be beveled at an angle of, say, 45°, and in such way that when edge is against edge, a 90° groove will be created. In order to secure a union, it is now proposed to heat up the sides of the groove to the melting point or nearly to it, and to fill in with new material, in a molten state, the entire groove. In fact, it is good practice to add more new material than is necessary to just fill the groove and so to create a rounded top. The workman holds his torch in the one hand and a rod, say, of Norway iron in the other. He begins at the bottom of the V-shaped groove, using the hot spot to soften the steel. When he has made a beginning of the closure and has a softened or melted surface of steel, he brings the end of the rod to the place. He seeks to add molten iron to molten or softened steel and thus secure a union of the two. He goes on in much the same way, adding molten iron to molten or softened steel until he has filled in the groove sufficiently for its entire length. The hammer is sometimes used; but it is hardly to be considered a necessary instrument when the heating and melting are properly carried out.

The result is clearly different from that produced by the old method of welding. We have here what is in fact a casting which has been formed in the groove. It consists of new metal. The procedure described is fairly typical. Nevertheless, there are many variations. Thus, it is not necessary that the V have a 90° angle. Sometimes, especially where the plates are thin, they are placed edge to edge without any beveling at all. It is, in fact, quite possible at times to unite plate to plate without the use of any new metal. The one edge is made to flow into the other.

The process may be used for purposes other than welding. The torch has been called a putting-on tool, because it may be utilized for the purpose of adding metal at some desired point. We can build up worn and broken cogs. We can add metal here, there and everywhere. We may in fact add a distinctly different metal. If an old casting has suffered the loss of parts, we may often build them up again. We use the hot spot to melt off metal from the rod and we thus get the new material in molten form. We also prepare the place where the added part is to go, and then add the new metal, thus forming a rough addition. Afterwards, the part can be machined or tooled to the precise shape wanted.

A little consideration will prepare us to perceive more or less clearly a field of usefulness in



Engineering Principles Apply to Boxes

HERE is a concrete example of the value of an unprejudiced Box Engineering Service.

On the left is shown the shipping box formerly used by a large metal manufacturer. The product is metal disks—circular in shape. This box is strong. Carries its contents safely. The steel bands give added strength and theft-protection.

The Pioneer Wirebound Box—shown on the right—was designed by a General Box Engineer. Note the shape and the consequent saving in displacement.

Equal strength and protection is obtained in the new box. The weight saved amounts to eighteen pounds per box. The product carries better because the Pioneer is designed to fit the shape of the product.

The cost of assembling is reduced. Twice as many Pioneers are assembled in the same time. Packing is easier, quicker. The cost of strapping is eliminated.

Enroute, the Pioneers save car space because they are nested in the car in honeycomb fashion. The destructive effects of shocks and strains are minimized. The Pioneers also handle easier —from the shipping room of the manufacturer to the receiving room of the customer.

Last, but not least, the customers highly approve of Pioneers. They are opened simply by cutting the wires—a matter of seconds. The top or sides are folded back, depending on the shape of the Pioneer. The contents are unpacked quickly without trouble.

If you would like to have a General Box Engineer design a box or crate to fit your product, just write us to that effect. This service costs you nothing—inconveniences you in no way.

A copy of "General Box Service"—an interesting booklet on better boxing and crating—will be sent to you on receipt of your request. Write for it today.

GENERAL BOX COMPANY

508 North Dearborn Street, Chicago, Illinois

SIXTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

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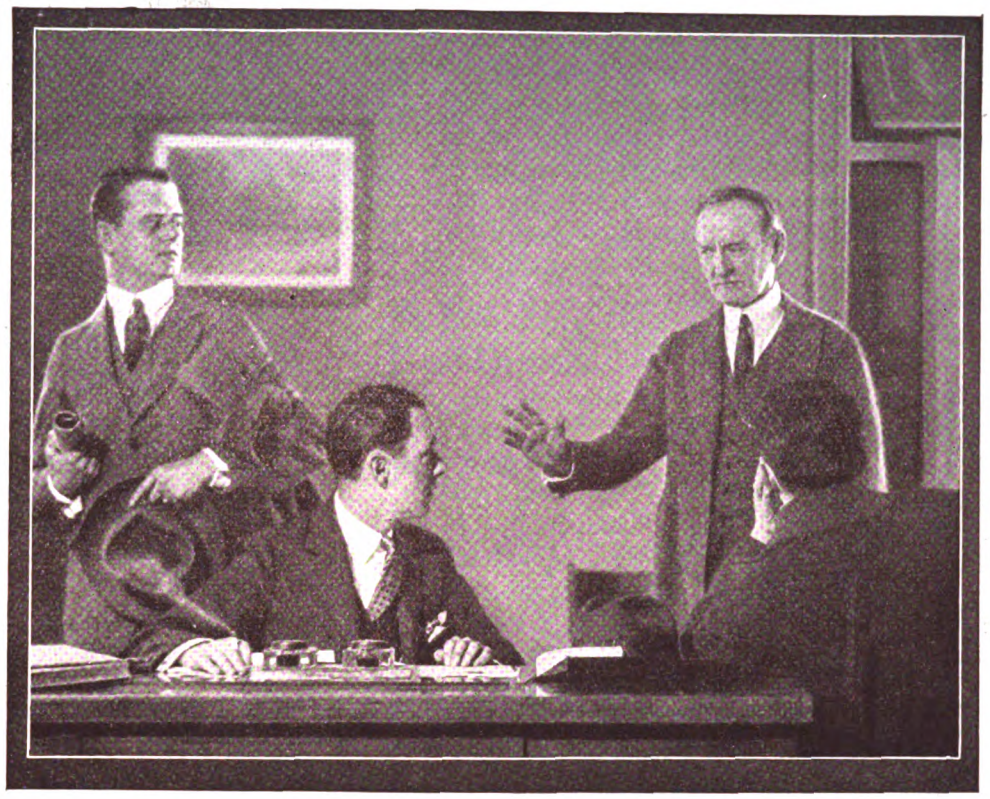
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surdly low in comparison with the loss otherwise in contemplation. The remedy can not always be applied and the defects perfectly rectified. The filled-in places may be points of weakness. But, it will often happen that the reclamation of the casting will be quite satisfactory, nevertheless, because the weakened points will never be overstressed in operation.

The application of the oxy-acetylene process to the cutting off of risers and other necessary but unwanted parts of certain castings is one of great importance, especially in steel foundries. We will return to the cutting procedure later.

The oxy-acetylene process is admirably adapted to repair operations. This results largely from two facts: (1) The procedure is carried on by *localized heating*, and (2) the entire equipment may be used in *portable form*. The fact that the heating operations are confined to very limited regions makes it possible to deal with a great multitude of repair jobs without involving the whole part in the



Where the Facts Came From

In its essentials this dramatized story is just like the case of a large company in the Middle West where the Consulting Engineers, The George S. Rider Company, with the interests of their clients at heart asked to have the heating taken out of their contract if the clients put in a steam system instead of the Grinnell Forced Circulation Hot Water System they recommended.

The booklet, "Five Factors in Heating Costs," will be sent to anyone interested in heating industrial buildings. Send for your copy today. Address Grinnell Company, Inc., 307 W. Exchange St., Providence, R. I.

It went across with a bang and—bounced back

"IT'S all set, Charlie," cried the President's son as he ran down the office steps towards the young man who was waiting for him in the flashy runabout. "The old gentleman says it's up to me entirely on equipping the new plant."

Charles Wilson: "Fine—we'll show them some economies that will surprise them."

* * * * *

President's son: "Here's your office. So long. Bring your estimate up to the office by 2.30. I've got a date with that Consulting Engineer—Chadwick. He's been going over your plans which I gave him yesterday. Your price will just bowl him over. Told him his preliminary heating estimate was way out of line. Mighty glad I got you in on this, Charlie. Gives both of us a chance to put something across with a bang."

* * * * *

Consulting Engineer: "I have been over your friend Wilson's plans, and I must hold to my first recommendation. If you will sign —"

President's son: "Sign nothing. Wilson's system is $4,000 cheaper. I want that saving."

Consulting Engineer: "$4,000, is that all? I should have expected at least $6,000 difference. I can't approve."

President's son: "Well, I propose to put it across with a bang. I'll sign your contract, Charlie."

Consulting Engineer: "Then you will please take the heating out of my contract entirely. My reputation, young man, has been built on operating economy and not low first cost. And operating economy depends not only on the type of system but the ability of the contractor to interpret my plans."

President (stepping into conference from his private office): "Now that you've 'put it across,' as you say, I will have to bounce it back. I arranged it so I could hear through the transom. I gave you this chance so you might learn today what it took me 20 years to get into my head about building and operating plants. Now boy, get this. An able consulting engineer knows contractors from experience just as he knows materials and design from technical training. You must follow his advice just as you would that of a famous physician. His plans and specifications are his prescription Have it filled by the contractor he recommends just as you go to the high class pharmacist your physician designates to fill his carefully worked out formula.

"I've preached this same sermon before the National Manufacturers Association and many's the letter I've received from members who took my advice thanking me for the trouble and money I've saved them."

Consulting Engineer: "A few words will make my position clear to Mr. Wilson and your son. Mr. Wilson's cheaper steam system required a steam boiler plant in a factory that buys electric power. Such a system didn't take into account operating expense which every year would be some $1,500 higher than with the hot water system Grinnell Company laid out for me. If you will read their book, 'Five Factors in Heating Costs,' you will see other reasons for my recommendations."

President's son: "But why didn't you let my friend Wilson figure on a hot water system?"

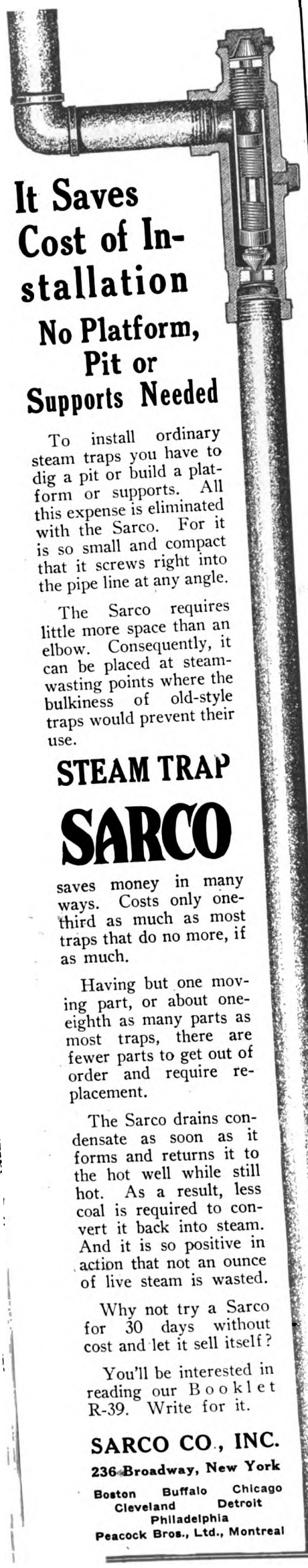
Charles Wilson: "To be frank, Tom, industrial hot water systems are a specialized engineering study. Nobody can touch Grinnell on that sort of thing."

GRINNELL COMPANY

Automatic Sprinkler Systems | Steam & Hot Water Heating Equipment | Humidifying and Drying Equipment | Fittings, Hangers and Valves | Pipe Bending, Welding, etc. | Power and Process Piping

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It Saves Cost of Installation

No Platform, Pit or Supports Needed

To install ordinary steam traps you have to dig a pit or build a platform or supports. All this expense is eliminated with the Sarco. For it is so small and compact that it screws right into the pipe line at any angle.

The Sarco requires little more space than an elbow. Consequently, it can be placed at steam-wasting points where the bulkiness of old-style traps would prevent their use.

STEAM TRAP

SARCO

saves money in many ways. Costs only one-third as much as most traps that do no more, if as much.

Having but one moving part, or about one-eighth as many parts as most traps, there are fewer parts to get out of order and require replacement.

The Sarco drains condensate as soon as it forms and returns it to the hot well while still hot. As a result, less coal is required to convert it back into steam. And it is so positive in action that not an ounce of live steam is wasted.

Why not try a Sarco for 30 days without cost and let it sell itself?

You'll be interested in reading our Booklet R-39. Write for it.

SARCO CO., INC.

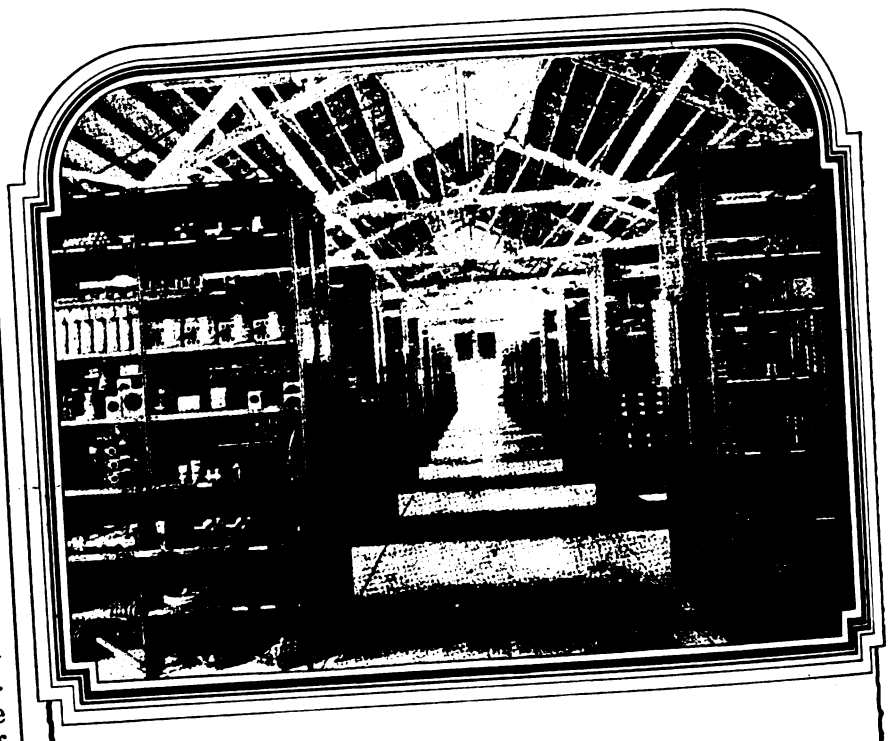
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Cleveland Detroit
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Peacock Bros., Ltd., Montreal

operations. For example, the frame or bed of a big piece of machinery may have cracked. It is frequently, perhaps generally, possible to effect the repair without heating the entire frame or bed. In fact, it will be often unnecessary to remove the frame or bed from the machine to which it is secured. That is to say, we may not have to do more than heat the region of the crack. Of course, the torch must be continually supplied with the two gases, so that it is necessary to provide supply tubes and to have working room to accommodate them. And, the workman must, naturally, be given room enough to get at the job. The feed tubes may be flexible and there is no great amount of space necessary for the operator. Consequently, very many jobs indeed may be satisfactorily done without dismantling the piece of machinery. The second fact, which relates to portability, makes it possible not only to avoid dismantling, but to carry on the operations wherever the big piece of machinery happens to be. It may, for example, be a case of a break in the frame or working parts of a big grain thresher. The machine may consequently be back in the country. Even so, it is possible to take everything necessary to the spot. The oxygen may be carried in a portable tank; so also with respect to the acetylene. These tanks may be transported by wagon or motor truck. The weights will total no more than a few hundred pounds. Portable supplies of oxygen and acetylene may also be conveniently moved about in a works, together with flexible tubing, etc. In this way, the welding operations may be carried on, now in this spot, now in that.

The process of using gas for welding purposes has been extended to cases where what is sought is not so much a welding together of two plates, for the purpose of making one single plate that is everywhere uniform, as a *sealing* of a seam or crevice against the passage of liquid or gaseous matter. For example, the roof plates of a steel passenger coach may be sufficiently secured by the rivets which unite the edges to the flanges of T-bars spanning the car transversely. But the seams may be sadly lacking in respect to the prevention of the entrance of rain water. The oxy-acety-

(*Continued on page* 46)



MEDART
Steel Shelving

for FACTORIES
WAREHOUSES
STOCKROOMS
SALESROOMS

MEDART STEEL SHELVING is the "filing cabinet of the factory." Simplicity—flexibility—strength—durability—economy, are some of its features which have gained for it the patronage of experienced buyers. Send for a copy of catalog S-7, giving complete details.



MEDART Steel Lockers

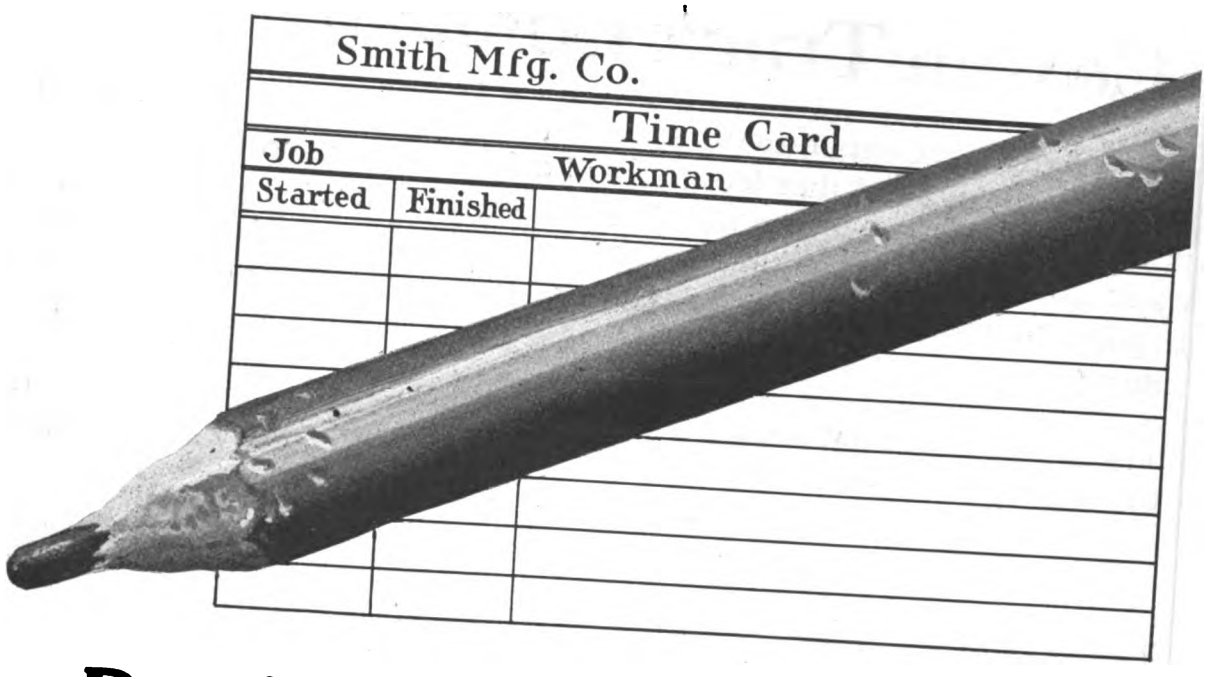
Medart Steel Lockers are furnished in all types and sizes to meet any need or arrangement. Write for catalog A-13.

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STEEL—the Symbol of STRENGTH

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Don't let this pencil st waste your money in 19

It is foolish to go through another year requiring your operators to keep their time on each job. They are poor time keepers at best.

Their interests are centered in other matters. When a job is finished they guess at the time which it took. Those guesses go to form the basis of your cost data. And it is a ten to one bet that your cost records are inaccurate.

Install a machine that records the *elapsed time* by a simple pull on a lever and save this money that you are wasting today.

The Calculagraph is a spring-driven machine free from the wiring troubles of electrical time recorders. It stamps the starting, stopping and *elapsed t* the job ticket.

It eliminates all errors o the operator. He no lon The printed record is there

It saves the time of cost cl no longer need to subtract s stopping time. The *elaps* be read direct from the job

Any number of workmen Calculagraph. A backw movement of the right hanc the job starts, a pull of tl lever when the job the time record is c

Send for our book Time Records" toc interest you.

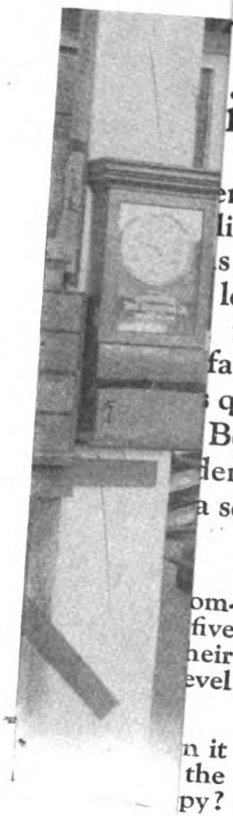


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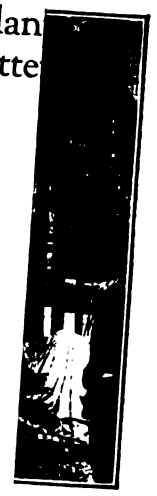
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Herein the Cowan Truck Company Presents t

If you study your cost figures and separate the time required for machine operations as against ance of time charged to the cost of that job, you will call for an accounting. The accounting bring out this fact; time spent getting materials to and from operations, storage areas, etc. Anal these statements and you will find Man-handling after Man-handling that *could* and *should* b *out*. It is at this point that the proper application of skid platforms and lift trucks will save outgoing payroll money.

Increased production in itself does not reduce costs, but merely gives an inspiration which spurs Management on to investigate labor saving devices. Many people today have reached the po

COWAN TRUCK COMPANY

HAND AND ELECTRIC LIFT TRUCKS
INDUSTRIAL TRUCKS AND TRACTORS

GENERAL OFFICE AND WORKS, HOLYOKE, MASS.

TO MEN CONNECTED WITH MANUFACTURING - WAREHOUSING - SHIPPING

The Cowan Truck Company as manufacturers of hand and electric lift trucks has, through its Engineers and the cooperation of its customers, designed lifting machines (or lift trucks), which give the greatest flexibility of application and, therefore, the greatest amount of payroll saving.

All equipment is Guaranteed as to Materials and Workmanship; parts are Interchangeable and Accessible. Features such as Ease of operation, Convenient and Effective Oiling System, Accessibility, Long Life, and Adaptability to both Light and Excessive Loads, have all been incorporated in the design.

We call your attention to the following EXHIBITS which bring out REASONS why you should have COWAN EQUIPMENT.

EXH'T.1 : COWAN LONG LIFE SKIDS AND TOTE BOXES
Riveting feet to lower flange of angle in addition to bolting them to upper flange and decking gives greatest rigidity. Countersinking holes in decking for large diameter flat head bolts gives smooth deck. Spacing of runners gives guide for truck and centers load.

EXH'T.8&9: COWAN TYPE G HAND LIFT TRUCK
Easy lifting due to Cowan's patented lifting mechanism - Positive latch and easy kickoff through the use of Cowan's "off dead center" patent. Easy rolling due to proper bearings and Alemite greasing system. Lowering cushioned by means of approved check. Variety of standard sizes.

EXH'T.20 : COWAN MODEL LLT ELECTRIC LIFT TRUCK
Strength - Power - Simplicity - Capacity - Flexibility Ease of Control - Anti-kick Steer - Four Trucks in one: Lift truck, Load Carrying Truck, Pusher and Baby Tractor.

EXH'T.21 : FRAME FOR LLT DESIGNED FOR STRENGTH - Five Inch Channel, Bumper, protecting elevating platform, built into frame.

EXH'T.24 : COWAN MODEL LLT ELECTRIC TRUCK CHASSIS
Wiring system carefully laid out. Three point frame suspension. Crowbar method of lifting employed - most efficient of all methods. Bronze or steel bushings throughout. Alemite greasing system properly installed.

EXH'T.28 : COWAN LLT DRIVING UNIT
GENERAL ELECTRIC Motors - Over size brake - Automatic Control - Simplicity throughout - Mechanical and Electrical Accessibility.

These features put Cowan Equipment in a Class by itself. Cowan Trucks show absolute superiority in flexibility of application and ability to withstand service.

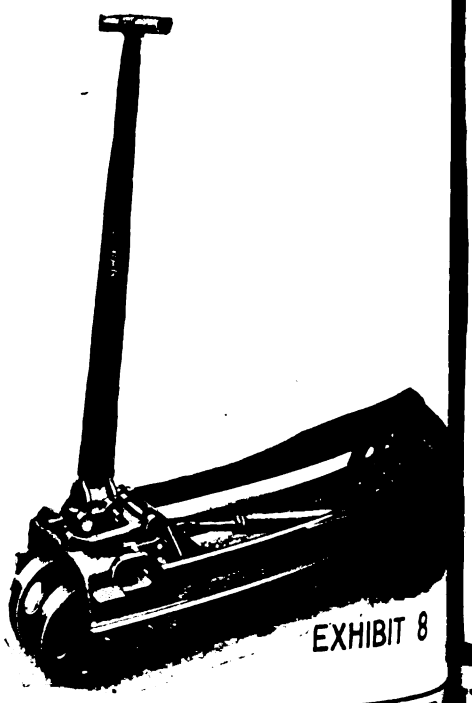
We will be glad to co-operate with you and will appreciate an opportunity.

Very truly yours,
COWAN TRUCK COMPANY

J. McEaton

GENERAL MANAGER





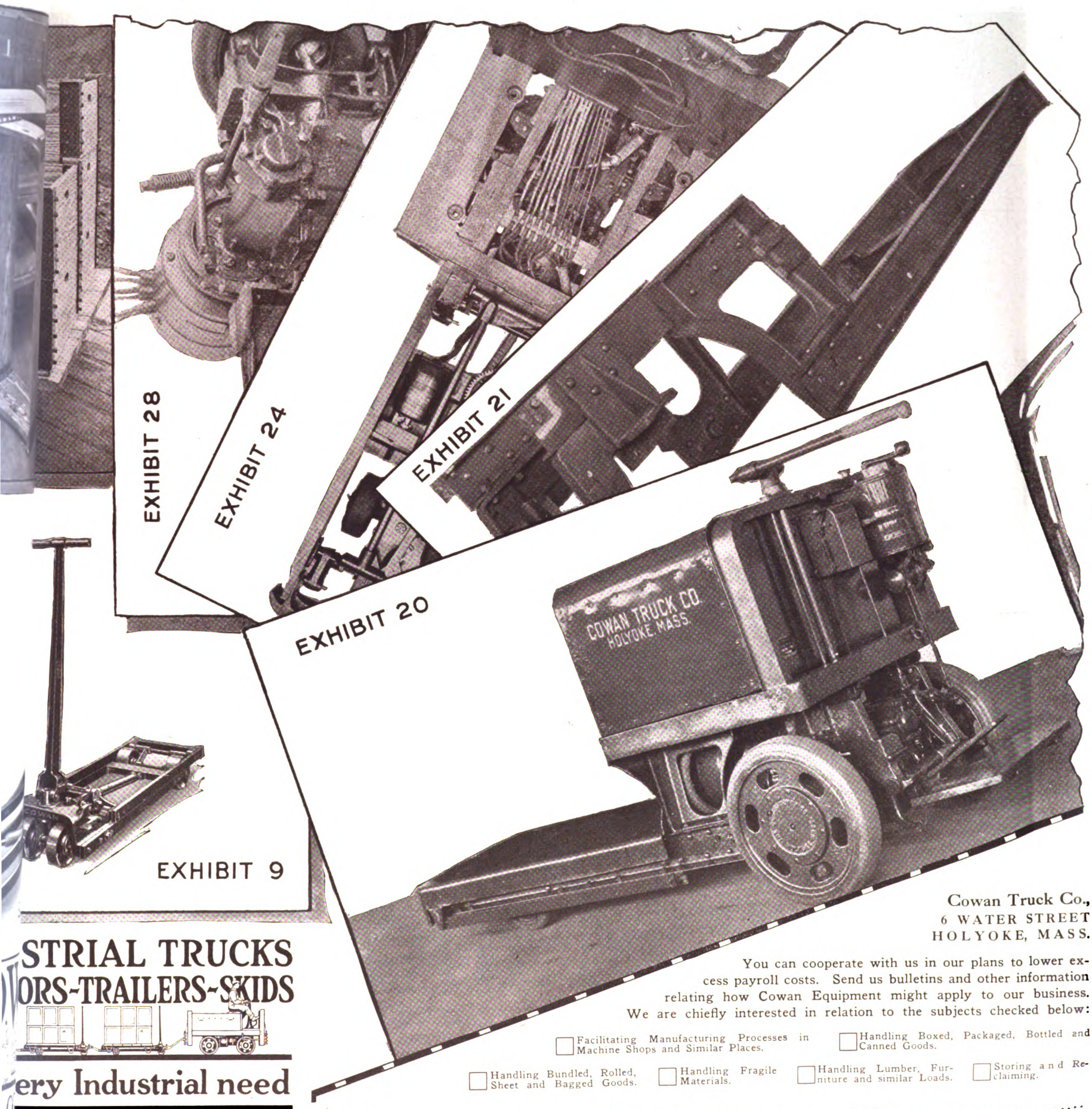


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HOLYOKE, MASS.

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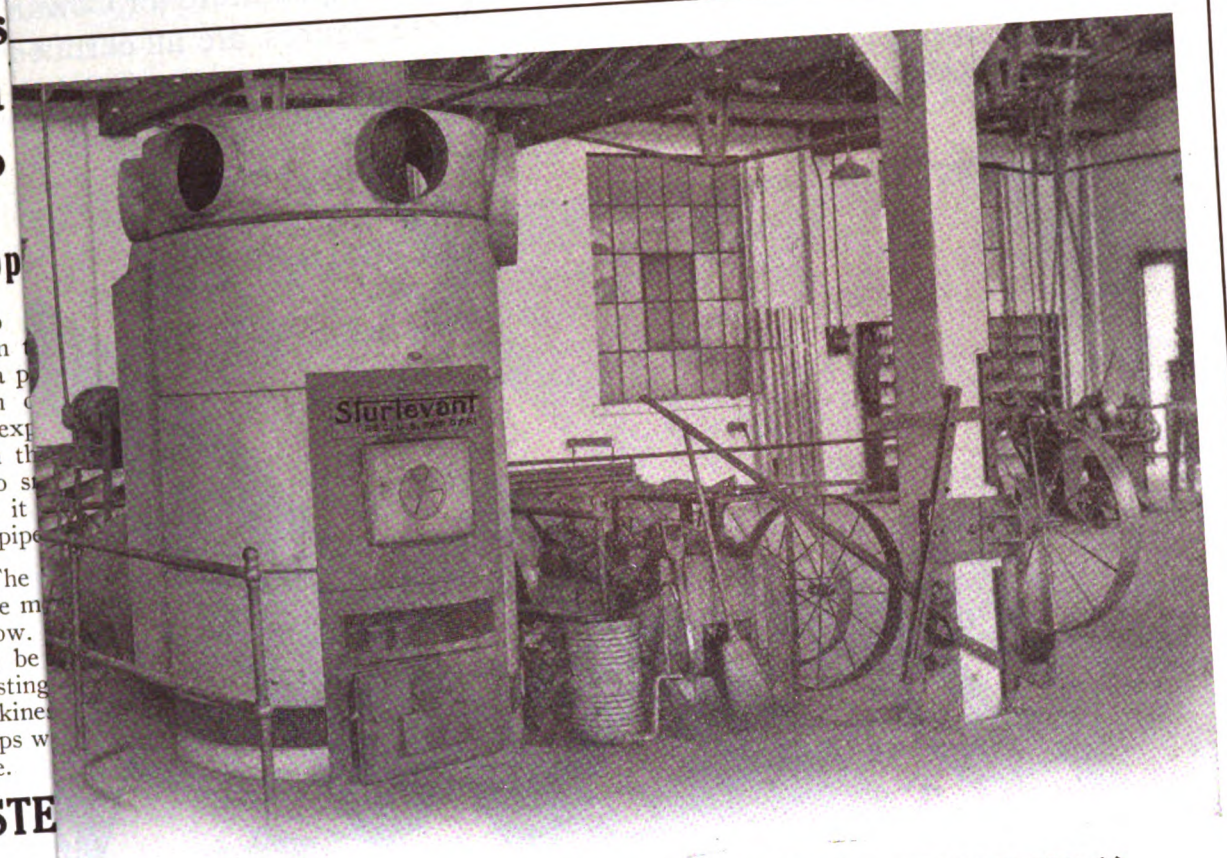
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(Continued from page 42)

process may be brought
s situation for the sole
of making the roof
ght. An application of
d was made early in the
n history of the new art,
writer knows from per-
bservation. There are
any cases indeed where
cess is applicable, cases

where the continuity of the metal across the seam is a matter of high importance. Some dozen years ago, a big steel water conduit was constructed in Colorado. The line was of considerable length and had to endure at points serious pressure from within. In fact, pressures ran up to something like 800 pounds to the square inch. I am excluding reductions for friction and the like. This pipe line, 9,000 feet in length, having a low level diameter of 3 feet 10 inches and a high level diameter of 4 feet 6 inches, was divided at the base for the purpose of serving two 10,500 horsepower water wheels of the impulse type. Our interest centers on the lower parts of the line, because of the events which followed the beginning of actual service. The pipe was shop assembled in sections of three lengths each. This meant a field union of sections at intervals of about 21 feet. There was a longitudinal joint made by riveting on cover straps of steel, wide straps inside and a single narrower strap outside. There were four lines of rivets, two to each side of the joint, and these held together three thicknesses of steel. The broad interior strap was additionally riveted to the pipe by two lines of rivets one line to each side of the aforesaid four lines. The circular joints were also made by girth straps riveted in place. The sections had to be connected up, in the field, by girth straps. And the longitudinal straps had also to be riveted in position where they overhung the pipe ends. The line was put into service. Leaks began to develop in a very short time. The caulking up of the field joints proved insufficient to hold back the pressure water inside the tube. The water, escaping with great force, threatened to extend the damage by the action of the sand in the vicinity. The sand would be caught up by the water jets and projected onto the rivets. In other words, wet sand blasts were in operation upon a vital part of the work. No effective method was known of stopping these leaks; so in November the line was put out of service, some three months after starting up. Here was a line costing somewhere round $250,000 (before the war) which was in large part a candidate for the scrap pile very soon after its completion. What was wanted appears to have been some method of sealing 200 field joints in such way that they would remain intact. It was not a matter of making strong joints, but of performing the equivalent of a caulking operation in the field in a manner better than was apparently possible by ordinary methods. The oxy-acetylene process was brought into use and solved the problem, sealing the external field joints in a total length of 4,000 feet and converting the cover strap into a single long piece of steel. There were also joints where the field girth straps joined the longitudinal band of metal, and these had to be sealed. Here was a big test for the new process. The work was done, in the field, in the



55 DEGREES IN ZERO WEATHER"

THE above remark refers to the heating results obtained by Sturtevant Hot-Blast Heaters in the Geneva Metal Wheel Company's plant, Geneva, Ohio. Following are two paragraphs taken from a letter written by their purchasing agent, Mr. Sawyer.

"We have four of these heaters installed in our plant and have obtained very satisfactory results with them in our foundry, core room. We have been able to maintain at least 55 degrees in zero weather and have used as fuel the ordinary ¾" lump steam coal, which is purchased for our boilers. As to the exact amount consumed during the winter season, we are sorry to say these figures are not available, but we know them to be economical.

"We had a call from your representative who went over our installation with us, and there is nothing in the matter of service that we need at this time. The heaters are giving us complete satisfaction, and we would not hesitate to recommend them for industrial heating."

Bulletin A306 gives the details

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Sturtevant
PUTS AIR TO WORK

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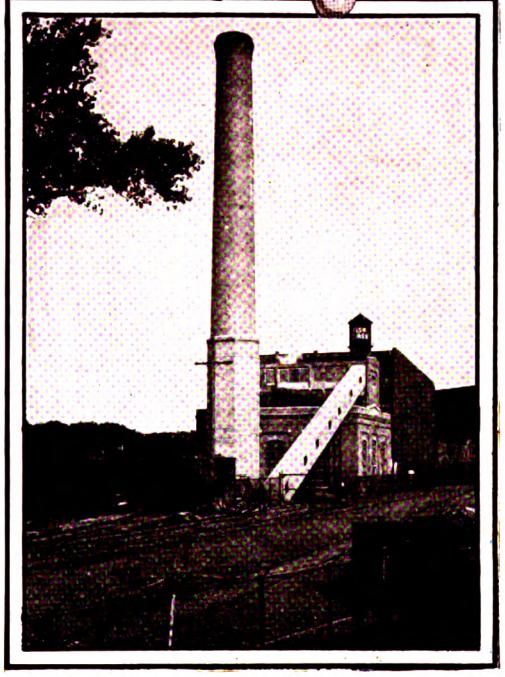
me, and was carried to
n in something like fif-
ks, if we except some
ant welds. The acety-
generated on the spot
successfully piped to
use having a maximum
of 500 feet from the
r. The oxygen plant
up at a separated point,
sisted of a generating
is and a gas compressor.
gen was transported in a
sed state to various
long the line, a construc-
mway being used or a
awn stone-boat. The
ie was manufactured
calcium carbide, some
1 tons of this material
equired. The oxygen was
d by the consumption of
venty-three tons of chlor-
otash. It was necessary
water for the generators,
of the severity of the
r. One expert welder,
l by four or five men, did
rk of welding, totalling, it
en estimated, some 667
feet. The general man-
said: "The company is
satisfied with the work,
els that without this pro-
f welding it would prob-
ave been necessary to re-
4,000 feet of the heaviest
n of the pipe." Let this
ce stand as a sufficient ex-
of the utilization of the
ss for sealing purposes and
illustration of the fact that
procedure lends itself to
ation in the field.

ong the repair jobs for
the oxy-acetylene process
been requisitioned is the
nation of wheels of various
. For example, a tractor
l has a break in the hub,
is of cast iron. A part is
lly broken off. And the
is nowhere to be found.
is a situation which might
the tractor out of service
very critical time and for a
iderable period, if it were
for such methods as those
h have been developed with
gas welding processes. It is
b which the oxy-acetylene
ler can do in his shop or out
he farm. He makes a mold
fills in the space occupied
nerly by the lost piece. How-
, when a wheel of cast iron
ther metal breaks across the
or across a spoke, the welder
p against the phenomenon of
ansion and contraction. The
nse heat applied to the new
al put into the groove until
s in a molten condition means
t this slug will contract very
considerably upon cooling. The result may be either a pulling away from the sides of the break or a contraction of the spoke or rim resulting in a new break at another point.

In fact, we have here an illustration of one of the principal problems encountered in the development of the new processes. Localized heating results in expansions and contractions which may create as much new trouble as there is old trouble. It is perhaps not too much to say that in the early period of development this problem constituted one of the greatest obstacles to the spread of the new method. Big castings, calling for small repairs in the shape of a filling in of several small blow holes, might be fractured in a drastic manner in the very carrying out of the repair. But, it is also probably not too much to say that this danger is now pretty well understood amongst expert welders and also very good methods of preventing additional breaks and fractures. The great remedy consists in preheating the region in and around

FISK TIRES





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The thoroughly modern plant of the Fisk Tire Company at Chicopee Falls, Mass., is equipped with five Edge Moor Boilers totalling 3746 H. P.—doing their part to keep the plant efficiency at the high level demanded by Fisk standards.

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Power house of the Fisk plant at Chicopee Falls, and Edge Moor Boilers in course of erection.

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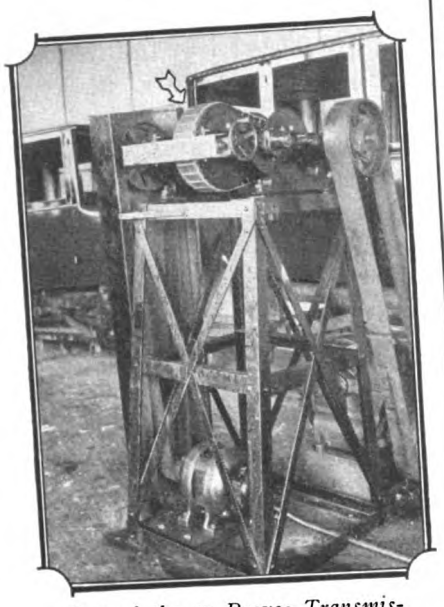
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Absolutely accurate control over a wide range of finely graduated speeds for their conveyors—one-third reduction in motor sizes—a substantial saving in power required—reduction of operating costs—improved quality of product through accurate production control—these are the advantages of vital importance that "The Reeves" Variable Speed Transmission has brought to the C. R. Wilson Body Company of Detroit, Michigan. They advise that it is paying them 41% annually on their investment. And "The Reeves" Transmission on your conveyors will do the same for you.

"The Reeves" Variable Speed Transmission

"The Reeves" Transmission is an efficient, economical, dependable and durable speed control device which is easy to install and simple to operate. For almost thirty years it has been the recognized leader wherever mechanical variable speed control is necessary to production efficiency —in plants of all kinds, large and small— throughout the world. Undoubtedly, it can fill an important need in your business. Write for 52-page catalog, L-44.

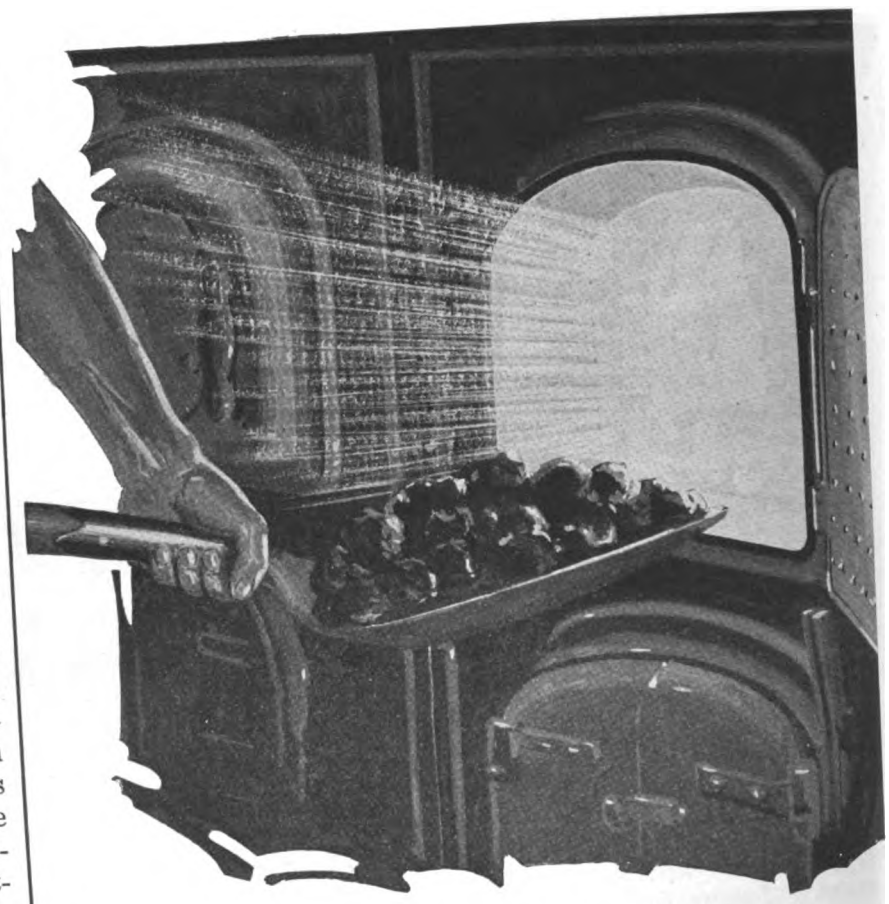
Over 95% of the mechanical variable speed control devices in the world's industrial plants are "The Reeves" Variable Speed Transmission.

Reeves Pulley Company
Columbus, Indiana

the proposed weld or sometimes in pre-heating the whole piece. Special appliances have been worked out for handling such work.

The reader who is non-expert may think that pre-heating obliterates the localization of heating by means of the torch. This is, however, not the case. The local heating with the torch seeks to produce a molten condition or a condition nearly molten. Pre-heating falls far short of this. A red heat or a heat a little higher is probably that which is most customary. The heating of the general region of the weld or of the whole affair to a moderately high temperature and of the immediate vicinity of the weld to a very high temperature result in gradations of temperature and thus the metal has opportunity for adjustment. Heating compartments are employed in pre-heating and also other devices. The pre-heating may be done by a coke fire, a fire bed by oil or by city gas or other means. It need not be at all dependent upon the oxy-acetylene torch. On the other hand, the big enveloping flame of the torch may often be used to pre-heat the work. Thus, in welding a straight seam, the torch may often be so managed as to heat the immediate region of the weld in advance of the high heating performed by the inner white flame. This kind of thing may frequently be managed in cases where the welding is done by a power-driven welding machine. This brings us to the development of mechanical appliances for the carrying out of certain classes of welding operations.

When the oxy-acetylene process is adopted as the method of uniting the edges of sheet metal in repetition work, the power-driven mechanical appliance is, for many cases, the best and most economical means of carrying out the welding operation. For example, suppose it is desired to make day after day a great quantity of containers. There may be a longitudinal seam for the body and circumferential seams for the attachment of bottom and top. I may use this case as an illustration of advantages to be derived from machine welding. The sheet metal in the containers may be quite thin, and the joints may be made by melting two edges and allowing the molten metal to run together. In such cases,



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The greater boiler capacity provided by mechanical stokers enables a stoker-fired plant to meet the heaviest load demands and there is always available reserve capacity to take care of increased power requirements. There are on record a great number of cases where increased steam demands would have made new boilers necessary except for this reserve boiler capacity provided by mechanical stokers.

Yes, stokers have saved boilers—and invariably they save coal and labor on an enormous scale.

The interesting facts are presented in greater detail in the free book, "Coal—The Basic Fuel." A request to the Secretary of the Association brings a copy to you.

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it may be very necessary that precisely so much heat—no more, no less—shall be continually supplied along the seams that is being made. An expert hand-welder can do the job, but it requires expertness and time. With a machine, the movement of the torch over this seam or of the work beneath the torch may be regulated so that it will proceed with great regularity. That is, the speed of making the weld can be made definite and regular. Moreover, the torch can be so adjusted relatively to this work that the hot spot will always be in its proper position. Some years ago, containers for the Edison storage battery were being made on two types of mechanical welding machines, and this procedure is perhaps still being used. One machine cared for the vertical weld in the body of the container, which was located a little distance away from one of the corners. The other machine welded the tops and bottoms in place. The material in use was steel plate that had been nickel-plated, and all seams were made by melting together two edges which were flat against each other.

A good deal of ingenuity has been applied to the design of seams in plate metal. There are many types of joint, and wisdom is needed in selecting the best for particular cases. In some instances, strength of seam will be wanted; in others, a smooth seam will be more desirable than a strong one. It is poor practice, in many situations, to place a seam at the exact corner of a container or vessel. And other precautions are more or less necessary. But, all this line of things has been pretty well worked out. Steel barrels and steel tubing are two lines in which machine work is serviceable.

The possibility of using the oxy-acetylene process in the cutting of steel has been highly developed. So also with cutting by the oxy-hydrogen procedure. By adding a jet of pure oxygen to the ordinary heating torch we produce a cutting instrument. The operation is representatively carried out as follows. First, the point at which the beginning of the cut is to be made is heated up without the oxygen jet. When the steel is red hot or hotter, the oxygen is turned on for the special jet. The torch may then be used almost as a saw. Tangled steel resulting from the collapse of steel structures can be readily cut up into manageable pieces. Heavy slabs may be cut across. Great bars may be severed. The cutting operation may in fact be carried on by the aid of mechanical appliances, and in this way both plain and complicated repetition work roughly cut to shape. In the foundry, particularly the foundry making steel castings, the oxy-acetylene process is especially serviceable, because the excessively hard protuberances that are not wanted may so readily be cut off.

The condition of trade and finance augurs well for 1924, and it can fairly be said that our outlook is one that every other country of the globe would gladly exchange for its own. Our industrial position is one of strength, without the appearance of embarrassing supplies of unsold goods which might seriously threaten the current price structure. Our labor is well employed at high wages, and was never before so well off as now. —*The Mechanics and Metals National Bank.*

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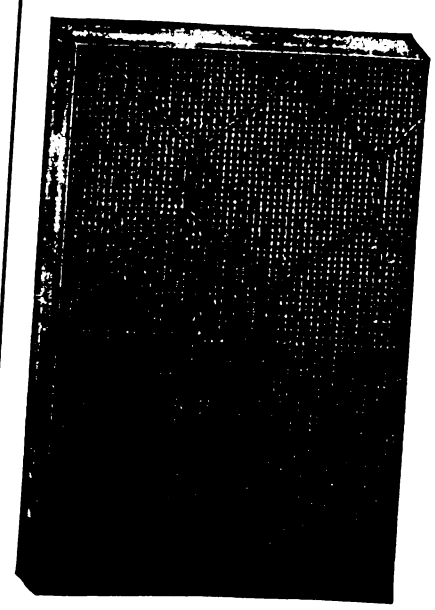
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Freeing the Human Voice from Its Inherent Limitations

(*Continued from page 17*)

they land. Not I. Writing American biographies has taught me that many a scared, outlandish, penniless lad who has had to run the gauntlet across Battery Park and up Broadway in his queer clothes without a word of English to answer back with, has written his name larger across the skies of this, his land and yours and mine, than many of us whose pedigrees go back to the Mayflower—has led the human race farther along the road of its destiny than the thousands who jostled him because he was a "foreigner." Had you stood by the causeway at Castle Garden on a day in 1870 would you have dreamed that you and the world were going to be eternally indebted, for those things you have before you tonight, to that unimpressive German-Jewish boy of nineteen you saw crossing there with his bundle? We are proud of America's leadership in the invention and use of the telephone. Who were the Americans who brought that about? Bell, the Scotch-Canadian; Berliner, the German; Pupin, the Serb! But Americans all, after all!

Our young immigrant went immediately to Washington and has always made his home in that city excepting a few years in New York and Boston. From a musical mother and a scholarly father he inherited artistic and studious inclinations which forbade idling away his spare time. He had finished the public schools in his native city of Hanover and he continued studying during his evenings, becoming especially interested in physical science. He found time, too, to carry on his violin music and to develop his talent for painting in no small degree. In New York he attended the free evening classes of the Cooper Union. For six or seven years he kept up this night study of science, turning his attention gradually to electricity more especially and fitting up a small laboratory for experiments with that form of energy, which they then were still calling a fluid. He was familiar with the attempts which were being made to invent a speaking telephone and in 1876 he began repeating the experiments of others and endeavoring to improve upon them. It took the dramatic enthusiasm of Dom Pedro at the Centennial Exposition to arouse the interest even of the scientists in the insignificant booth tucked away behind a staircase where a young Boston teacher of deaf-mutes at the last moment had been permitted to exhibit the first instrument of that line of marvels of which the latest is the telephone at your elbow.

The significance of that primitive telephone lay in its potentialities. As it stood it was only a scientific curiosity, a toy, of no use in the everyday service of humanity except as entertainment is useful. Only a trained speaker, enunciating his words with utmost distinctness and with his mouth pressed into the mouthpiece of the transmitter, could make himself plainly heard and understood for more than a few words at a time. Receiver and transmitter alike were actuated by magnetos, just as your receiver is today. The

WORTHINGTON

This Compressor Saves $775 a Year

The air compressor shown is a Unaflow steam cylinder machine having a capacity of 1,500 cubic feet of air per minute. This compressor under usual conditions will save 4,980 pounds of coal in an eight-hour day, as compared with a Meyer Gear Compressor—a saving which amounts to $775.00 in a year.

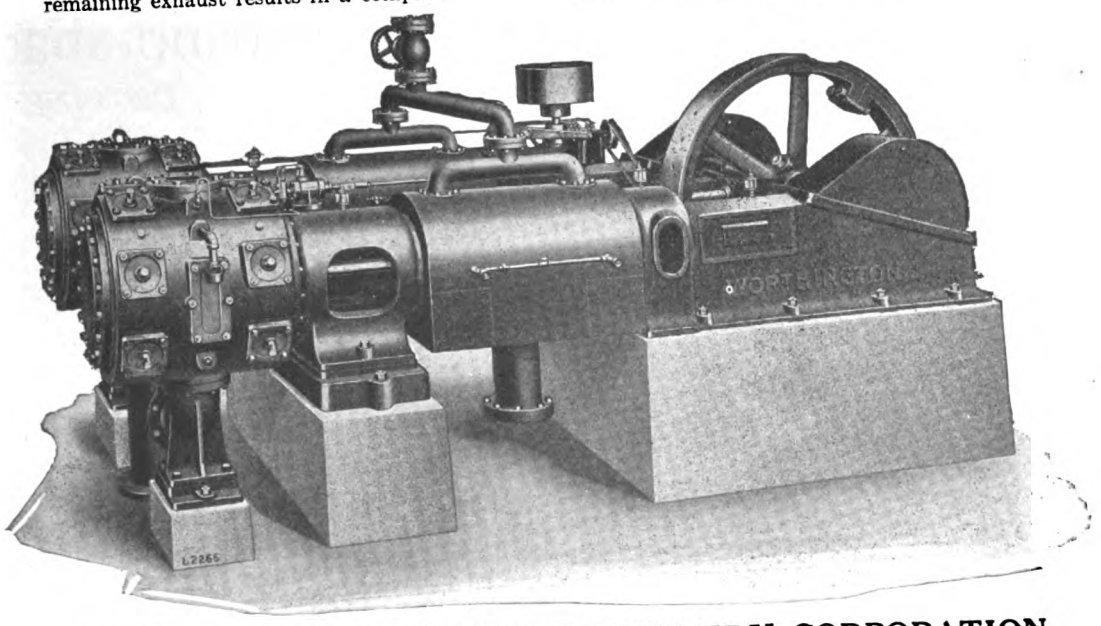
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Another contributing reason for the exceptionally high economy of the Unaflow compressor is high compression. As the steam, expanding away from the cylinder head, rushes out through the central exhaust port, it carries practically all the wet steam out through the exhaust. When the exhaust port is closed, by the returning piston, the remaining steam, which is comparatively free from moisture, due to the effect of the steam jackets, is compressed to practically initial pressure.

This adiabatic compression of the remaining exhaust results in a compression temperature actually above the initial steam temperature. The live steam, upon entering the cylinder, thus comes into contact with steam filling the clearance at practically its own pressure, and at a temperature higher than its own. Furthermore, the surrounding metal surfaces are likewise at initial steam temperature.

As a result, cylinder condensation is practically eliminated, and a performance is obtained that is most exceptional. Worthington Unaflow Compressors lead the market by their remarkable economy and smooth operating qualities.



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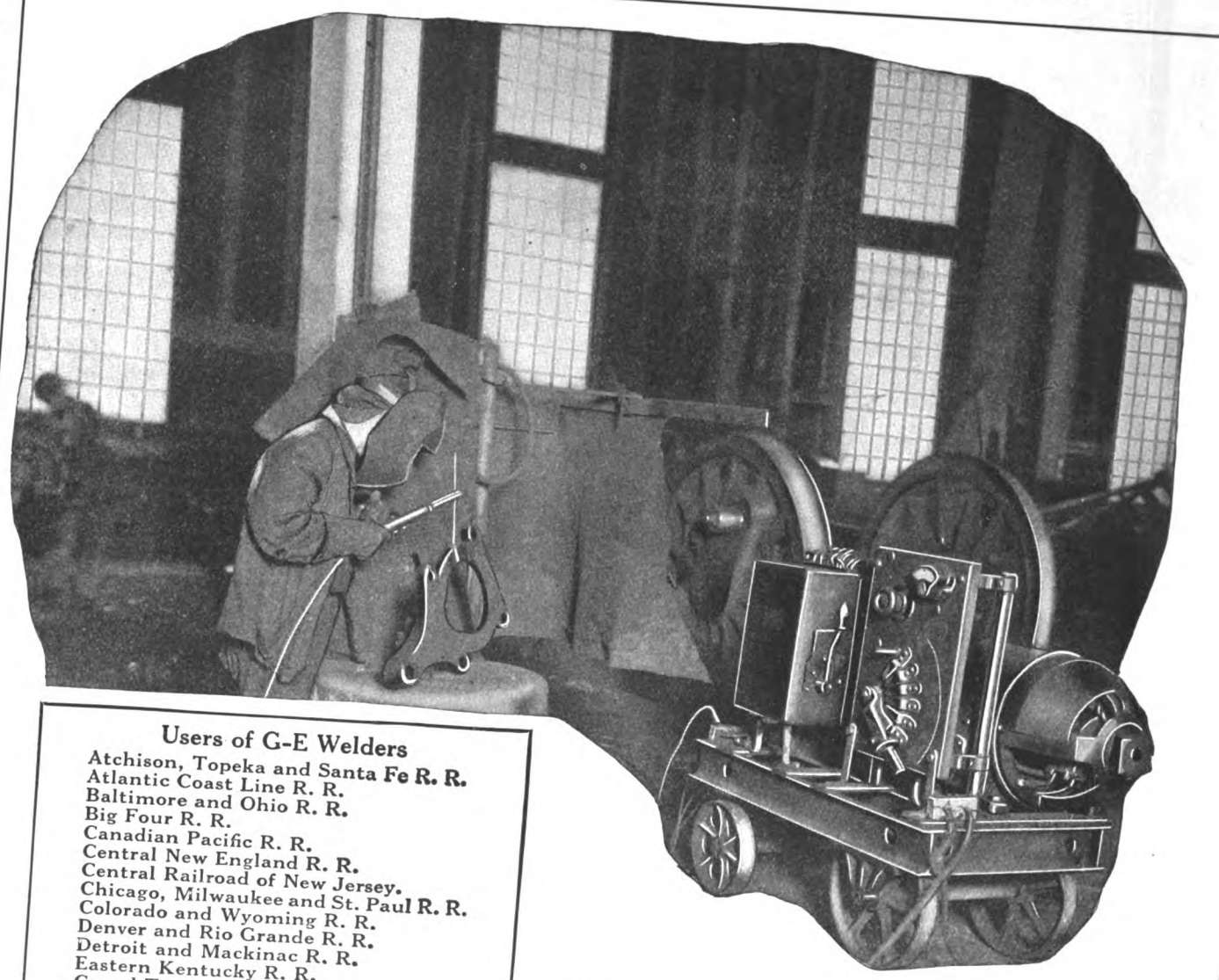
diaphragm was an animal membrane with a small disc of iron glued to its center to serve as the magnet armature.

Young Berliner grasped the significance of this crude appliance and its shortcomings as well, and he was spending his leisure hours almost entirely on experiments with it. As he tells it, "I thought it might be possible to use a battery current instead of the magneto, and to get the necessary electrical vibrations by varying the quantity or energy of the current instead of by the undulations of a continuous magnetic current. I did not catch on right away to the mechanical pressure principle for maintaining continuous contact at the vibrating point, and made several futile experiments." Here comes into play that combination of imagination or vision, deep and extensive study, and training of eye and hand, which characterize the practical inventor. The telegraph being an electrical means of conveying signals, Berliner had studied it profoundly both as to principles and practice. He learned to operate and one day about this time while he was in the fire alarm central office he started to show his friend Richards, who was chief fire alarm officer, what he could do in the way of telegraphing a message. In a minute Richards said, "Hold on, that isn't right. You must press the key down hard, not simply touch it, or the man at the other end won't get it." Berliner asked, "Do you mean to say that more current passes over that contact when I press hard?" Richards replied, "Exactly," and Berliner bolted out with the remark, "All right. Good-bye. I've got it!" He had, and he knew it. He rushed home, rigged up a diaphragm, using a highly polished steel button for a contact point, and connected it with his galvanometer. When he pressed his steel button harder, although it was all the time in contact so the current was passing through it, his galvanometer needle was deflected, giving evidence that he had accomplished his purpose of producing variations in a continuous current by altering the mechanical pressure at the contact point.

That was heresy. If there was any decalogue in electrical science, the first commandment in it was that thou shalt not tolerate a loose contact anywhere in your circuit. It could not conduct the current properly, it would burn out the terminals, and the sin brought various other penalties on the head of the violator. Today's heretics even do without wires! Berliner, working his discovery out, went a step farther and eliminated the skin diaphragm, making it entirely of sheet iron, and got infinitely better results. He did not know that Bell meanwhile had discovered the same thing about the diaphragm. In the course of these experiments he evolved probably the simplest electrical telephone ever made, merely a sheet iron diaphragm with a steel ball pressed lightly against its center. With two of these hooked into an electrical circuit, when a friend spoke into one he heard him through the other, three stories below.

Here was an instrument radically different from the Bell magneto telephone, and he filed a caveat in the Patent Office in April of 1877. Fourteen years later, fourteen years of fighting, he was granted a patent over

(*Continued on page* 53)



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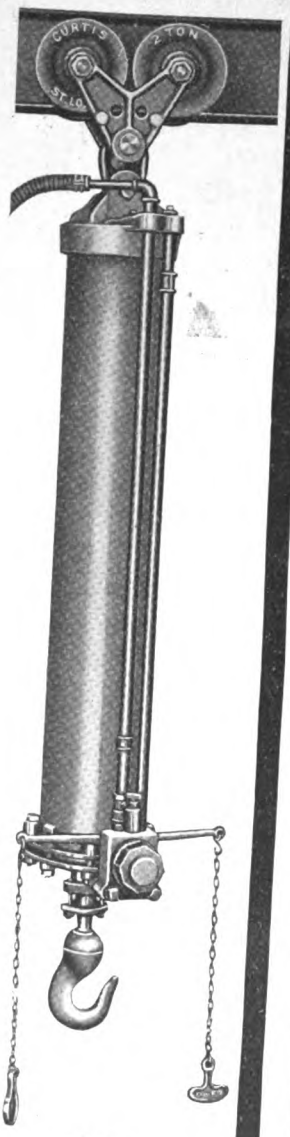
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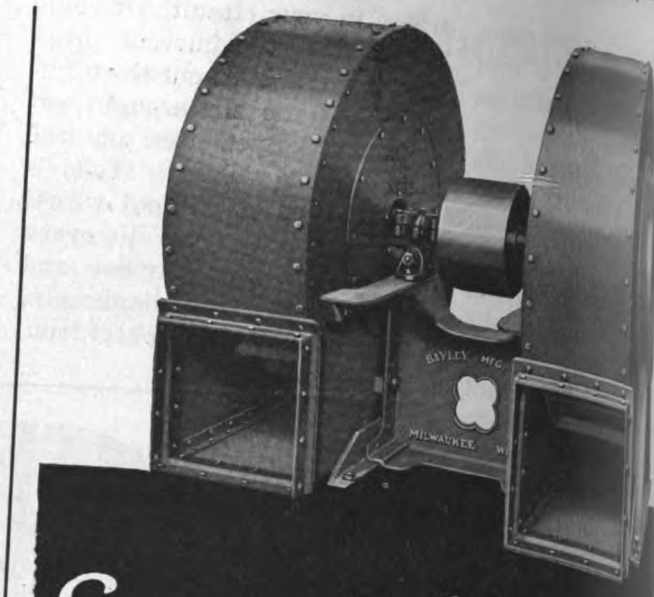
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(*Continued from page* 51)

claimants whose names are the names of the great in the electrical world. But the loose contact principle which he had established was not much more than a principle. He had not yet evolved a practical device for its application to every-day requirements, for it was incapable of stable adjustment. The very passage of the current through the restricted point of contact heated the points and broke the contact, necessitating constant re-adjustment. Here was a difficulty. Time to quit? Another famous American, asked that question, fired back the answer, "Surrender? Tell them I haven't begun to fight!" Berliner's resources, in intellect and patience, have never been exhausted yet; they have barely been tapped. He has an open mind—open at both ends. Its explorations are not arrested in the one direction by any closed, prohibitory doors marked, It Can't Be Done, It Must Not Be Done, or It Isn't Being Done; nor, in the other direction, is it impeded by the inhibitory formula of self-satisfaction: I have gone farther than anybody else, and that is far enough.

No; the fact that the door had opened a crack was proof that it could be swung wide. He had pried open that crack by doing something against the rules, and, if it stuck, there must be a way of applying leverage to the door, or lubricant to the hinges, that would make it open. The line current running through the instruments heated the contact points. But you had to have a current through the instrument to initiate the impulses. There must be a current over the line to transmit them. Current must run through the receiving instrument to receive the impulses and convert them into sound waves. Consequently you had to have a current running through the line and through the instruments; you could not deprive the instruments of electricity just because it heated them up. Wait a minute! Wasn't there a way to accomplish that paradox of cutting the instruments out of the line and yet supplying them with current which could transmit and receive electrical impulses to and from the current in the line? Yes! with an induction coil!

Again he had it. Berliner connected up his line wire with the secondary helix of an induction coil at each end of the line, and connected the primaries of the induction coils with the battery and loose-contact points of his telephones. Early in 1878 he received a patent for this latest improvement. These two improvements, the loose-contact transmitter and the use of the induction coil, were vital links in the commercial development of the telephone industry of the next few years. But for them it came near to being the Western Union Telegraph & Telephone Company instead of the Bell, or American, company as you know it today.

The Western Union Telegraph Company saw in the speaking telephone a competitor likely to make serious inroads on its business, so it proceeded to take the offensive by going into the telephone business itself. Bell and his associates were but a group of experimenters with little capital, while the Western Union was one of the largest corporations in existence at that time, with millions of capital, thousands of offices and wire lines already installed the coun-

SKF



Ball Bearings on Motor Sweeper
Prevent Needless Interruptions to Service

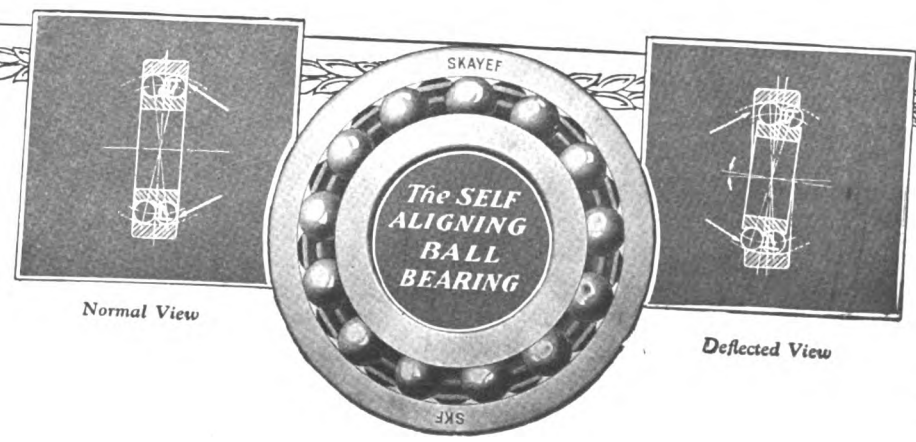
ON automotive equipment of all kinds from pleasure cars to huge trucks, fire engines, motor sweepers, etc., Skayef self-aligning ball bearings are daily demonstrating their great economic value to the user through their unfailing performance, high operating efficiency and long life.

Used on the vital rotating parts of this motor sweeper self-aligning ball bearings operate freely and with no appreciable wear despite misalignment and heavy shocks and jars which would soon destroy ordinary bearings. As a result the ball bearing equipped parts are maintained in their original accurate settings without need of bearing adjustments with their accompanying withdrawals from service and heavy dismantling expense.

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Normal View

Deflected View

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The Highest Expression of the Bearing Principle

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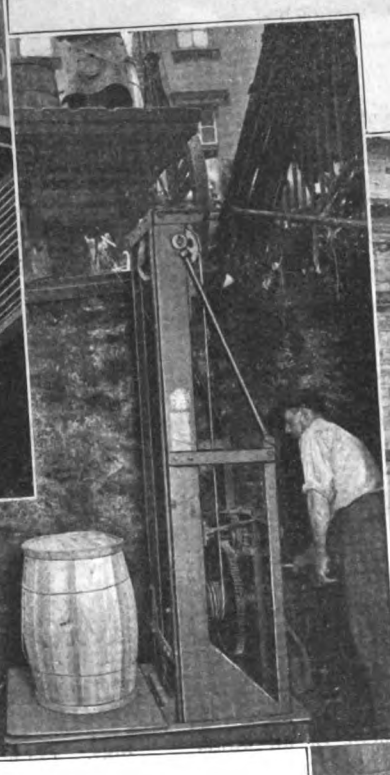
try over. If ever a David was confronted with a Goliath, this was the time. The telephone was far from a perfect instrument and therefore was capable of vast improvement. The Western Union, with its almost limitless resources, engaged the most eminent electrical experts —Edison, Gray, Dollbear—to solve the problems involved. Legal talent of equally high order attacked the patents. The Bell attorneys, studying the several telephone patents, ran across Mr. Berliner's and advised their principals that here were some patents they ought to control. They took the advice and made a contract with Mr. Berliner so he became one of the Bell group.

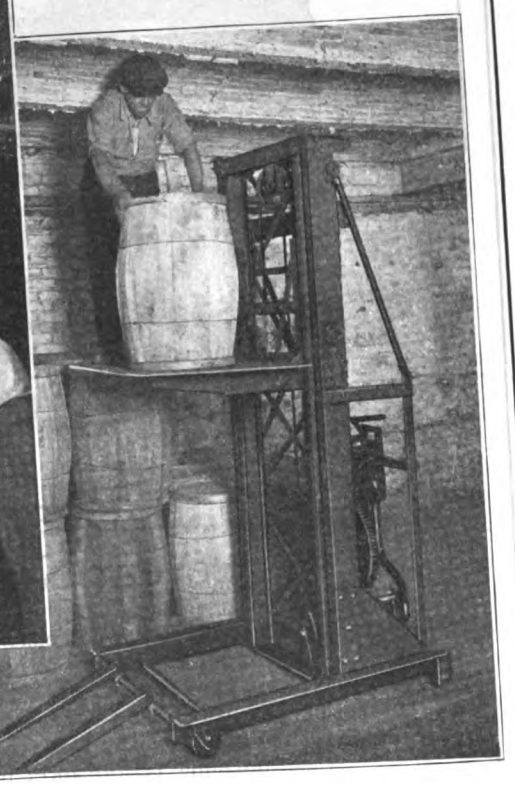
Meanwhile Francis Blake, Jr., had experimented with the loose-contact transmitter and brought out his adaptation of it as the standard Bell instrument. He had a special way of mounting the contact points and used carbon—arc light carbon—for the "button" point, while the other was a metal bead. The transmitter was extremely unsatisfactory in service, however. It would not remain in adjustment more than a few hours. Overnight it would become completely useless. Mr. Blake's health failing, he had to withdraw from active service, so the company sent for Mr. Berliner and put up to him the problem of perfecting the Blake transmitter. He soon found that the difficulty lay in the softness of the carbon. The metal bead, by its constant vibration, dug a hole in it. As he had used gas carbon to make the button point in his own transmitter and knew how much harder it was than electric light carbon, he decided to use it again in the Blake instrument. Gas carbon was too hard to work with tools, so, drawing on his ingenuity again, he made his buttons of the soft carbon, put them in a steel cage, had the gas company put them in its gas-making retort, and they came out coated or penetrated with the hard gas carbon. And the Blake transmitter was finished! Previously they had been made laboriously and slowly, one by one, and no two exactly alike. It took a trained man to adjust them and a trained voice to speak with any satisfaction through them. Now all that was changed. Action was positive, adjustment permanent, and the "boomy" distortion of the voice disappeared. Orders were given to turn out two hundred a day, and Mr. Berliner personally inspected the first 20,000 instruments before turning his attention to other research work.

This was the stone in little David's sling, for with it he killed off Goliath. The Western Union electricians were getting no nearer to a satisfactory improvement of the telephone, while the comparative perfection of the Bell service with its Bell-Berliner-Blake instruments was attracting subscribers faster than either mechanical or financial resources could supply them. The vital advantage of the Bell system lay in its transmitter. So the Western Union capitulated and withdrew from the telephone business on the agreement of the Bell Telephone Company not to compete in the telegraph field.

In principle that transmitter has never been changed although of course in construction there have been considerable improvements. In the course of the patent litigation, several years after he invented it, Mr.







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with this Economy Portable Elevator

It Telescopes

HIGH or low—up through the trap door to the wagon level or down under the low brick arches in the basement, the Economy Telescoping Machine adjusts itself automatically and does its work at either height.

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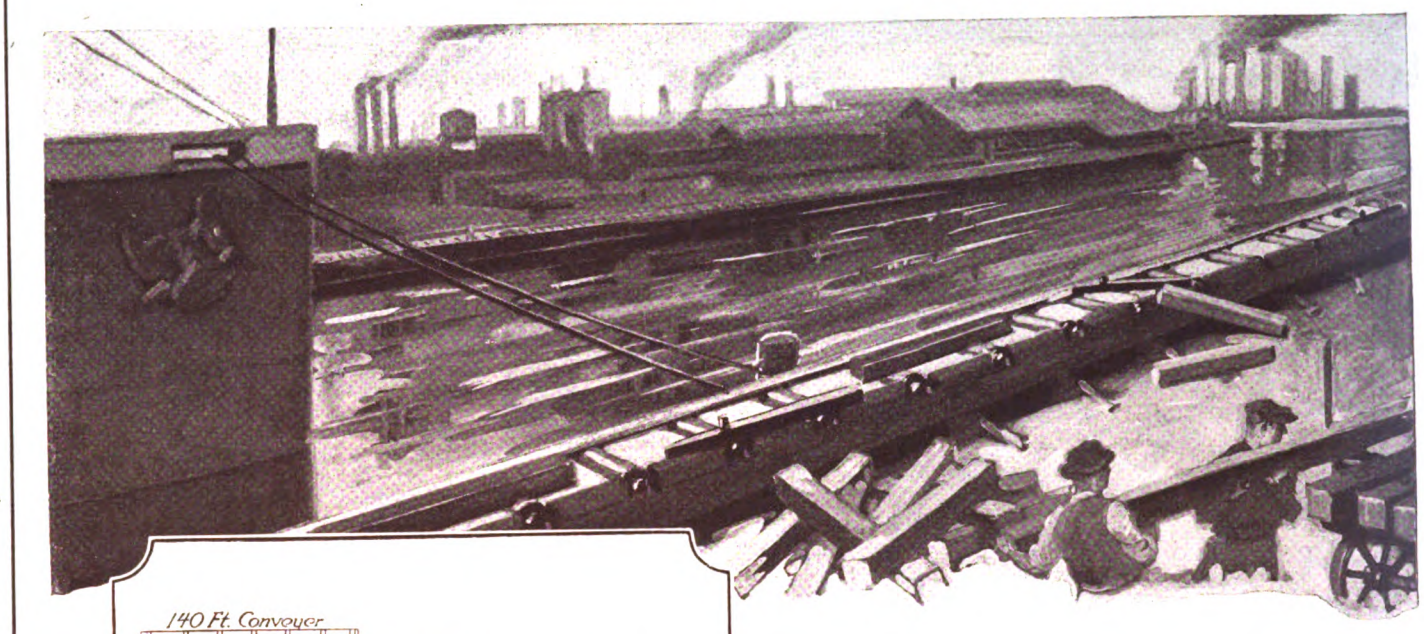
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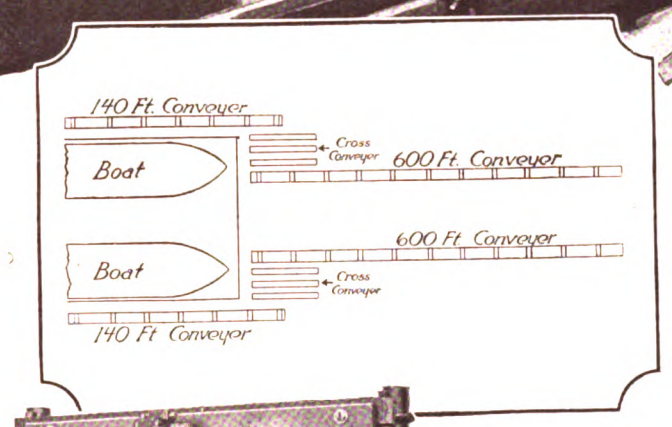
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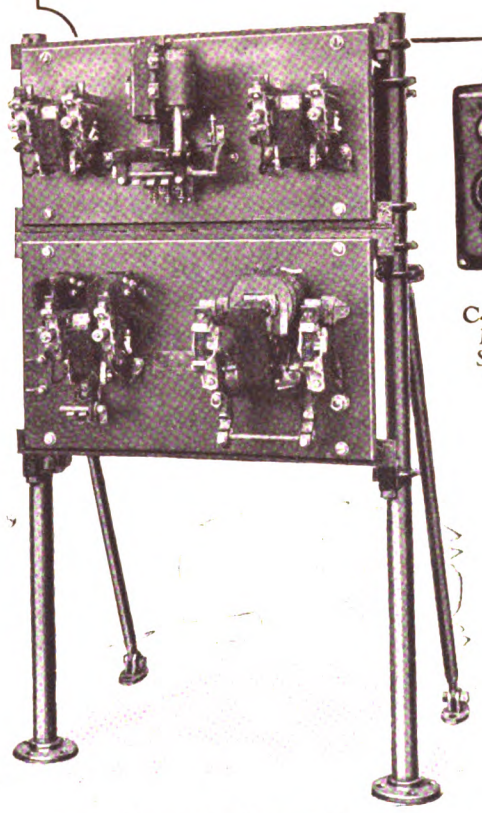
ave an interesting and g demonstration of the his caveat, filed early described the elements leted invention, utiliz- se contact between the s. In the Bell Tele- Company office there an imposing company rnment attorneys and xperts, telephone law- entists and professors. ernment men were in tion of contending that, r. Berliner had not men- arbon points as essential invention, other claim- o did specify carbon had rights. Mr. Berliner, presence of this distin- group, took an ordinary s telegraph key, with ontact points, of course. noved the heavy spring placed it with a light re- ring, adjusting it care- ntil he had a very light, ontact at the points, so ld hear the ticking of his laid on the baseboard of y. Then he had the gov- nt's attorney, to that man's astonishment, sim- lk at that Morse key and vernment man with a tele- at the other end of the downstairs, heard all he That silenced all opposing ments. It proved that what ner had described in his t was a real telephone.

t only could he discover iples, devise and produce ratus to apply them, but he set it all down in clear uage, for he wrote that at himself. The Bell Tele- e Company's leading coun- n much of the subsequent ation once told Berliner wished he had also written patent application himself, ead of having a lawyer do It would have saved them a f trouble in getting it recog- d and granted.

Edison, while experimenting h the telephone, struck a il which led to his invention the phonograph. Berliner's rk followed much the same rse. In Edison's machine the ord was made on a tin-foil inder with a needle or stylus ich vibrated vertically, mak- g a helical groove of varying pth corresponding to the voice orations. Berliner saw there uld be several advantages if e record groove were made in flat spiral on the surface of a sc, with the vibrations appear- g therefore as horizontal aves. The most important ad- vantage would be that the stylus would cut its groove through a coating on the disc of even thickness and therefore of uniform resistance, whereas a needle cutting vertically into wax (tin-foil having been superseded) met a variable resistance, increasing in an increasing ratio with the depth of the cut. Another factor was that the spiral groove would both vibrate and propel the reproducing stylus. Again, duplicates of the record could be made directly from it by electro-plating or some other contact method. His knowledge of music and his profound study of sound in connection with his telephone inventions and research stood him in good stead when he directed his energies in this new path, eight or nine years after the first phonograph appeared. Space will not permit following the steps by which Berliner developed his ideas into a practical mechanism in a little over a year from the time he started. On May 16, 1888, he read a paper at the stated meeting of the Franklin Institute of Philadelphia in which he was







C-H Alternating Current Type Automatic Controller



C-H Push Button Station

Where Electric Control Replaces Human Labor

In the lumber yard of Church E. Gates & Co., on the East River, Brooklyn—the lumber from ships is conveyed under the control of tower men who merely press buttons. Cutler-Hammer Automatic Controllers govern the starting and stopping of the motors driving the conveyors and respond to the push button control stations.

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For ten years this C-H Control has been in operation—one of thousands of cases where co-operation between industrial men and C-H Engineers has resulted in the saving of human labor, the speeding up of processes, the protection of motors and machinery, the exact duplication of operations, the lowering of costs, the improvement of product.

Over a quarter of a century of continual experience in the designing and application of electric control, from the simplest motor starting rheostat to the most intricate control system, is at your disposal. Engineers from any of our offices will be glad to call at your request.

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Motor Control Department
***Works:* MILWAUKEE *and* NEW YORK**
Offices and Agents in Principal Cities
Northern Electric Co., Ltd., Canada

C-H CUTLER-HAMMER **AUTOMATIC CONTROLLERS**
FOR CONVEYORS AND MATERIAL HANDLING EQUIPMENT

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able to say: "In nature provision seems to be made for all the wants of mankind. Confident in this belief I kept on trying to find a trail which would lead to promising results, and I have the honor tonight, for the first time, to bring before you this latest achievement in the art of producing permanent sound records from which a reproduction can be obtained, if necessary, within fifteen or twenty minutes, and which can be accurately multiplied in any number by the electrotype process. It may be termed, in short, *the art of etching the human voice.*"

In the same paper Mr. Berliner, suggesting the "practical applications" of his invention, made a number of predictions of such startling accuracy that it is interesting to repeat a few of them. He said: "A standard reproducing apparatus, simple in construction and easily manipulated, will be placed on the market at a moderate selling price. Those having one may then buy an assortment of phonautograms (records), to be increased occasionally, comprising recitations, songs, vocal and instrumental solos or orchestral pieces of every variety. . . . Prominent singers, speakers or performers may derive an income from royalties on the sale of their phonautograms. . . . Whole evenings will be spent at home going through a long list of interesting performances. . . . Languages can be taught. . . . Addresses can be delivered by proxy."

And then the audience listened to the first gramophone program: Yankee Doodle; Nancy Lee; Home, Sweet Home; Annie Laurie; a cornet solo; the Declaration of Independence. The original metallic records and one copper duplicate made by ordinary electrotyping were used for this demonstration. It took Mr. Berliner five years more to work out the present method of duplicating records by pressing an electrotype reverse of the original into softened rubber, celluloid or shellac compositions. Innumerable other improvements and refinements kept his inventive ingenuity busy until the day has arrived when a prima donna can stand beside the instrument and if she makes the motions of singing the hearers cannot tell whether the music they hear comes from her throat or from the machine.

The Franklin Institute has awarded him the John Scott and Elliott Cresson medals for his important contributions to the development of the telephone and the talking machine, but his work has not been confined to those instruments. With his eager mind roaming far afield in the domain of applied physics, Mr. Berliner has done considerable experimenting with helicopters as a means of aerial flight. Again, he addressed his painstaking genius to the airplane engine and developed a 90-horsepower, duplex, gyro motor weighing but 215 pounds. On November 1, 1914, with this motor installed in a Dayton tractor plane at College Park, Washington, De Lloyd Thompson, from an altitude of a thousand feet, climbed 2,800 feet higher in three minutes. A great deal more could be said about this achievement, marking Mr. Berliner as the first to succeed in making the lightweight, internal combustion engine with revolving cylinders now so extensively used in air-

(*Continued on page* 58)



An Investment of $400,000.00 in Jeffrey Carriers *by* 6 Industrial Leaders

The six Industrial Leaders whose well-known trade marks are featured above, are using 16 Jeffrey Pivoted Bucket Carriers for the handling of large quantities of bulk products such as coal, ashes, sugar, vegetables, etc. The Jeffrey carrier is specified wherever year-in and year-out service without shutdowns is required.

The original cost of the Jeffrey Pivoted Bucket Carrier is many times offset by preventing costly shutdowns. Quality in materials used, material strength and hardness of wearing parts means long and satisfactory service for the Jeffrey Carrier.

A few of the Long Service Qualities embodied in the Jeffrey Carrier are: Steel Side Bars of high carbon; Glass Hard Double Bushings; Large White Iron Rollers; Tough Malleable Iron Overlapping Lip Buckets, etc. All wearing points in chains are hardened and ground.

The Jeffrey organization, its engineers, its equipment and its two generations of experience are at the disposal of Industry to meet its present needs.

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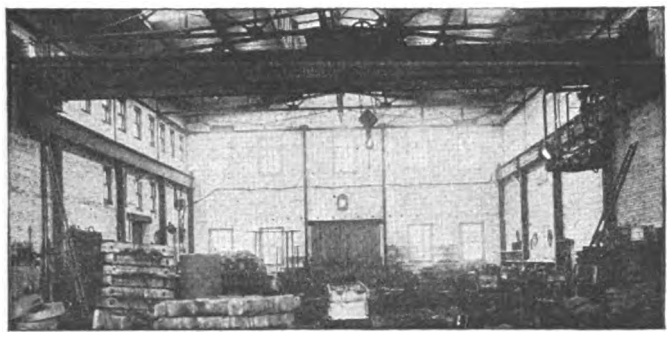
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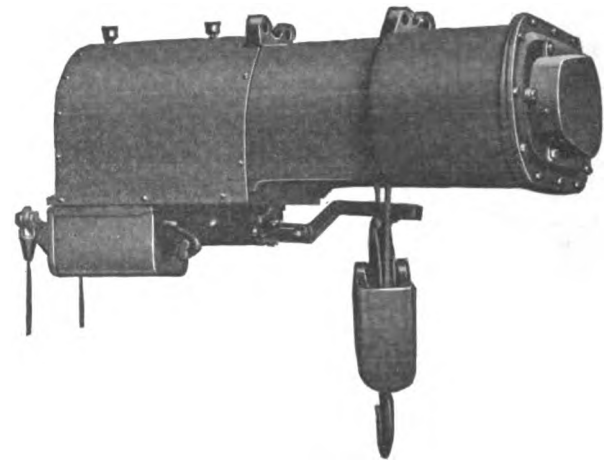
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ELECTRIC HOISTS

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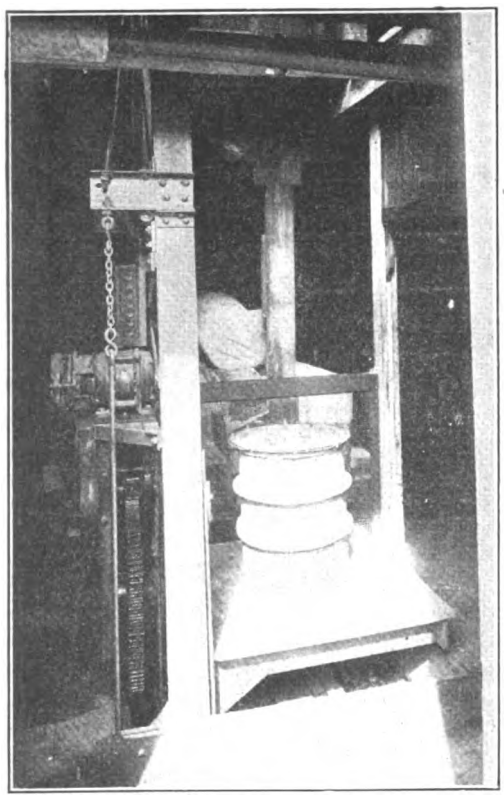
Cut steel gears and pinions running in oil.
Roller bearing. — Short headroom.
The construction is simple and built for service.

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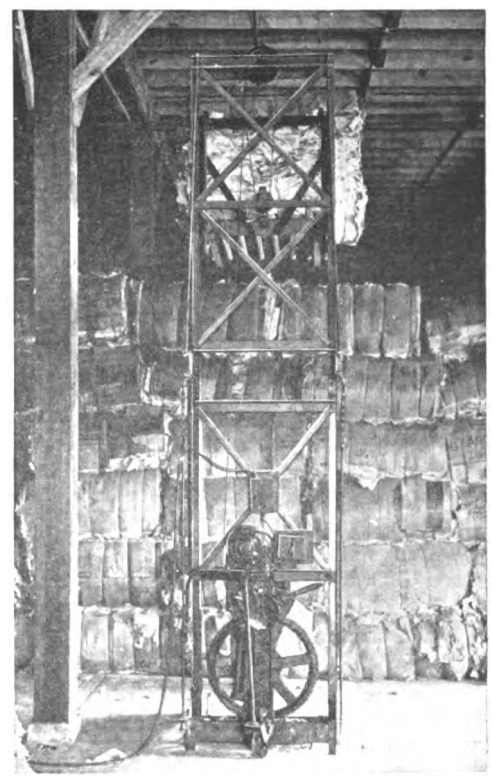


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PLATFORMS—Any size you want.
LIMITS—Electric top, bottom and intermediate if needed.
SAFETY—Does not depend on any mechanical adjustment.
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Tell us what your elevating problem is and we will show you a DELTA for the purpose. We have 60 standard sizes, hand power and electric for prompt shipments.



Electric DELTA handling baled stock.

NEW JERSEY FOUNDRY & MACHINE CO.

90 West Street, New York City

80 Distributors **Incorporated 1885**

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(*Continued from page* 56)

planes, particularly in European practice.

And now we must not overlook, even in so brief a sketch as this, an intensely human side to Emile Berliner's character and life work. When he had lost one child and came near losing another his inquiring mind sought the reason and found it in the impure milk which was served the household. Realizing that the effects upon his own family must be multiplied many times over throughout the city and nation, he saw the enormous proportions of the harm that must be due to the milk supply. Studying that broader aspect of the question, he learned how much infant mortality, typhoid fever and tuberculosis could be traced to the same source. In 1901 he organized the Society for the Prevention of Sickness and ever since has devoted a considerable part of his energies and funds to a widespread campaign against the dangers of raw milk and in favor of pasteurizing the milk supply in addition to more stringent sanitary control of its production and transportation. In that work he claims only to be following in the footsteps of Nathan Strauss, who blazed the way in New York City. But Mr. Berliner, by planning the first Milk Conference, in Washington, attracted the attention and support of the Federal Government and therefore was a powerful influence in giving the campaign a national character and correspondingly greater effectiveness. By himself and in collaboration with others he has written and published a constant stream of pamphlets and articles in that warfare against preventable filth disease. Its results are seen in his home city in an amazing reduction in the morbidity and death rates.

His is a life of decisive and far-reaching achievement, in no single field, but well-rounded withal; a personality strongly marked, but in traits of such range that it is well balanced. "The elements so mix'd in him

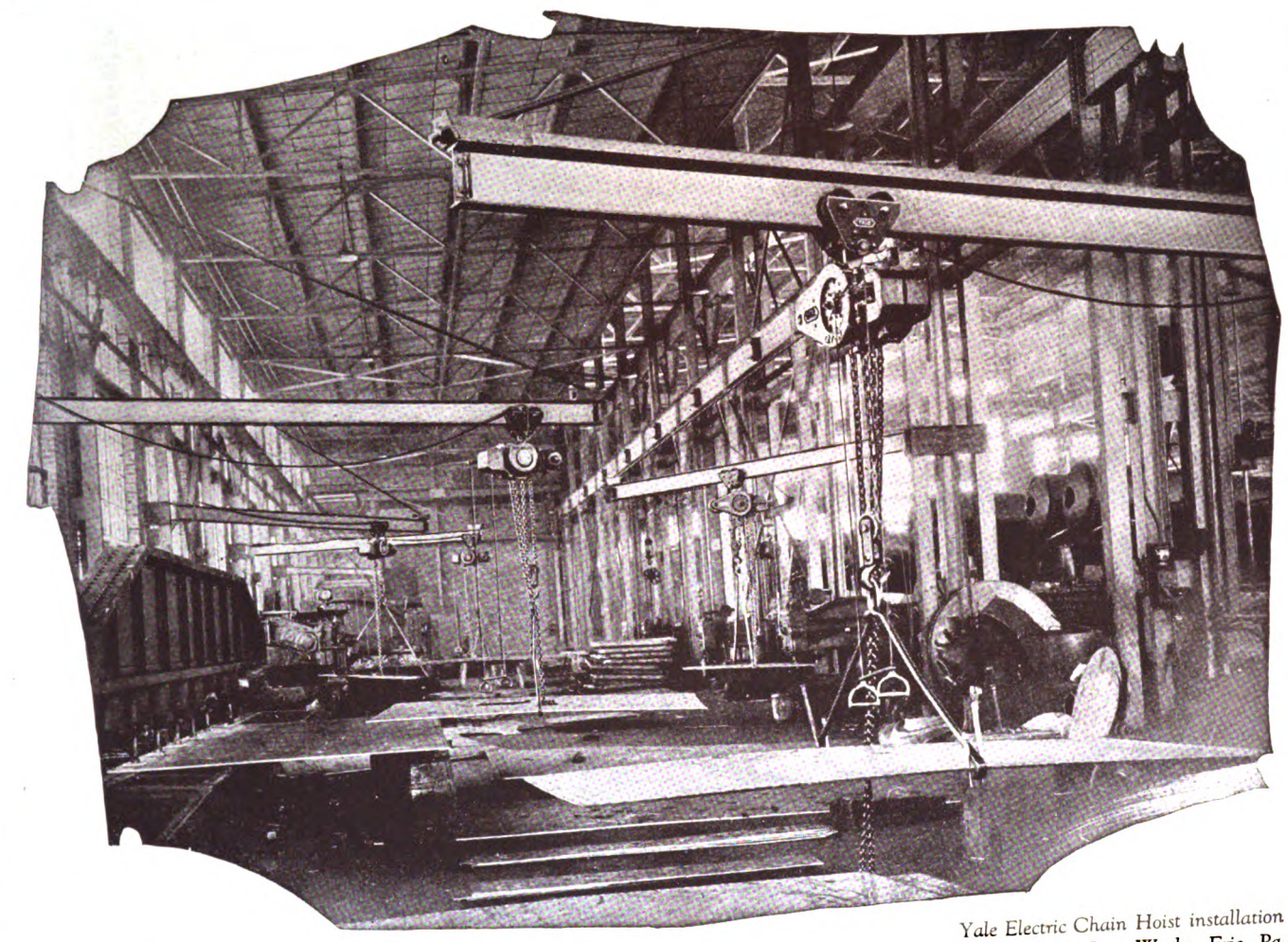
That Nature might stand up
And say to all the world,
'This was a man.'"

The arts and sciences; painting, music and physics; mechanisms and the humanities; genius that has imprisoned the voices of great singers in imperishable copper and made possible the fourteen million telephones of today in this country alone, and a heart that is just as keen and indefatigable in the fight for national health—these are not inconsistencies, they are but the different facets of a many-sided nature.

What has been Emile Berliner's greatest service to humanity? Is it the telephone improvement that determined the destiny of the industry? Is it the instrument which will enable posterity to hear Caruso? Or will it be some leader of the race, some genius, whose life was saved in infancy by his fight for pure milk?

Some far-off day, when his perspective is great enough, he will know.

Cleaning tests of small sizes of central Illinois coal have been completed by engineers of the Department of the Interior attached to the Urbana, Illinois, experiment station of the Bureau of Mines. These tests, which have been checked in commercial coal washing plants, show that it is entirely practicable to reduce the ash content of the screenings.



Yale Electric Chain Hoist installation at the Union Iron Works, Erie, Pa.

A Unique Application of Yale Electric Chain Hoists

THE use of the 2-ton Yale Model 20 Electric Chain Hoist on the bull riveter shown in the foreground of the above photograph, furnishes a most interesting example of Yale methods. This hoist and the bull riveter replaced an expensive electric riveting outfit at a saving of several thousand dollars.

The bull riveter is stationary and the assembling work is spotted by the Yale Electric Chain Hoist. This requires frequent movements of from two to three inches between operations.

Six other 2-ton Yale Electric Chain Hoists in this plant are used on jib cranes serving punches and shears handling heavy plate and structural work in and out of the tools.

Of first importance in this work is accuracy of load spotting. The work must be practically level and in the right position when punched or sheared. The fact that six Yale Electric Chain Hoists, all mounted on the new Steel-Plate Roller Bearing Trolleys, have been installed is ample evidence of the value of this Yale combination for such work.

Write for complete information about the Yale methods of handling heavy, bulky loads quickly, safely and economically. Yale Chain Blocks, Electric Hoists and Electric Industrial Trucks have been applied in every industry with the result that production has been speeded up, handling costs reduced and profits increased.

YALE
Chain Blocks, Electric Hoists } For Lifts
I-Beam Trolleys, Industrial Trucks } For Shifts

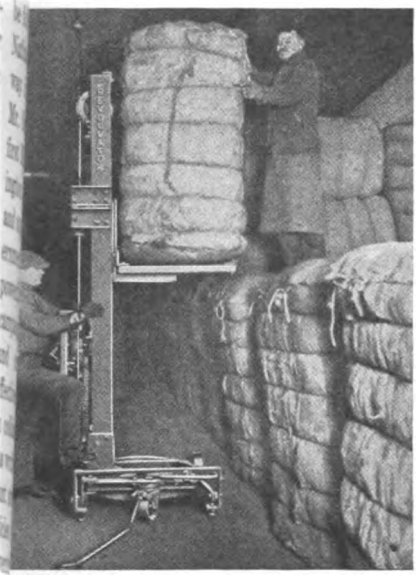
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International Paper Co.
American Can Co.
Vacuum Oil Co.
American Woolen Co.
Eastman Kodak Co.
Pratt & Lambert Co.
American Chain Co.

These 12 companies are operating 300 Revolvators. An average of 25 each. One has 40; all have over 15 Revolvators.

ORE PILING OF MATERIAL WITH FEWER MEN

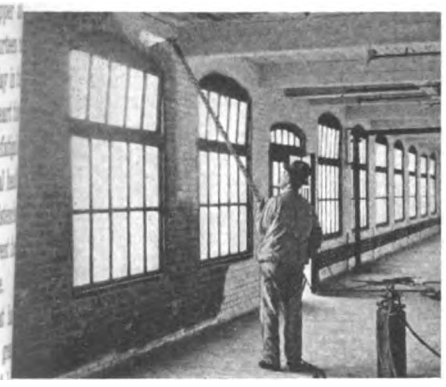
Revolvator, a portable elevator that can be furnished with er a revolving or non-revolving base, will pile more goods with er men than labor alone will ever pile. The Revolvator is made many styles and sizes, hand operated, motor driven or com- ation hand and motor driven. You can get a Revolvator to every piling requirement.

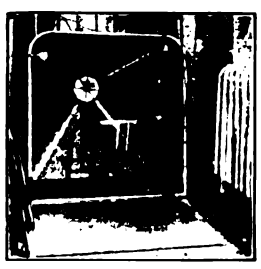
We would like to tell you the story of what Revolvators are doing for others. Send for Bulletin IND 60 to-day.

rtable Elevators Lift Trucks Barrel Racks

REVOLVATOR CO.

322 Garfield Ave., Jersey City, N. J.







Re-paint Your Plant ne "SPRACO" Way

Saves 50%-85% on Labor Costs alone. Requires fewer men, takes much less time, and does a far superior job in every way. Practically no interference with operating schedules. Does away with most scaffolding. Enables you to maintain a "daylight" factory at lowest cost.

SPRACO Industrial Finishing Equipment is the most efficient and scientific method of applying protective and decorative coatings to all kinds of manufactured commodities. Saves the time of 3 to 5 men. Investigate SPRACO before you buy.

Send TODAY for SPRACO Bulletin P-86

SPRAY ENGINEERING COMPANY

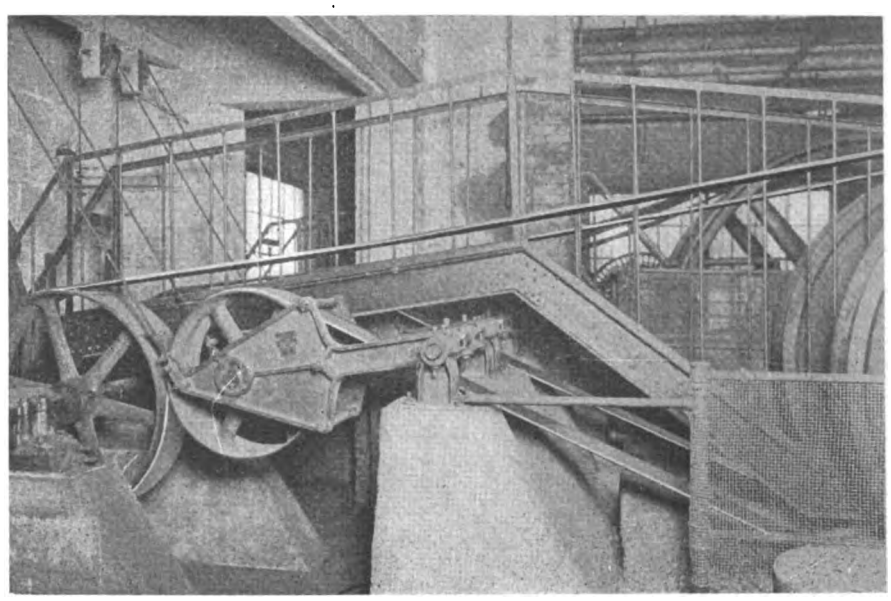
60 High Street, Boston, Mass.

Manufacturers of
Air Washing Equipment
Spray Cooling Equipment
Paint Spraying Equipment
Flow Meters
Park Sprinklers

Engineers for
Spray Cooling Systems
Irrigating Systems
Aerating Reservoirs
Air Conditioning
Gas Washing

TRADE MARK
SPRACO
BOSTON

Speed Painting and Finishing Pays!



Two multi-stage Compressors driven from Lineshaft through Lenixes. Lineshaft turned by 200 H.P. Motor also with Lenix.

The Lenix Drive

Is the *original* short center belt drive

In the eighteen years that have elapsed since the first Lenix was placed in operation, thousands have been sold. The drives on which they are installed range from 1 to 1400 HP with belts from 2" to 60" wide. Some of the drives have the tight side of the belt on top, some on the bottom; some are horizontal drives, some vertical and others quarter-turn.

The Lenix is not an "idler." It is a "belt wrapper," scientifically applied to belt drives for the purpose of eliminating belt slippage and increasing the capacity of the drive.

Booklet

Saving Slippage and Space

---tells more about it.

Send for a copy.

F. L. SMIDTH & CO.

ENGINEERS

50 Church Street New York, N. Y.

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Any Road Is Suitable for TECS



No special roadway is required for **TEC TRUCKS.** They get over any road—carrying the heaviest loads.

TECS ride with equal facility over Belgian blocks, cinder filled paths, through snow, ice and sleet—up a 20% grade with a 2½ ton load—in fact the toughest roads mean nothing to **TEC TRUCKS. TECS** are never put up for winter storage—they are all-year-round industrial trucks for outdoors and indoors.

And remember the short turning radius means manoeuverability in the cramped aisles and blind alleys.

A few of the **TEC** features, given here, show why **TECS** are chosen where strength and durability are requisites.

Write for descriptive circular

A Few TEC Features

- Separable Bodies
- No Loading and Unloading Delays
- Individual Wheel Drive
- No Differential
- No Bevel Gears
- No Friction to Slip
- Four Full Leaf Springs
- All Motors on Truck and Attachments Interchangeable.
- Vehicle Motors Used
- 20"x5" Solid Rubber Tires
- 3800 lb. Drawbar Pull for Tractor Service When Needed

TERMINAL ENGINEERING CO., INC.

15 West 44th Street,

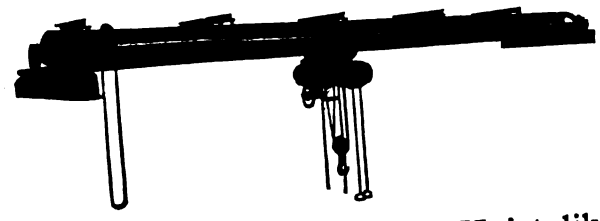
New York

District Engineers in Various Cities

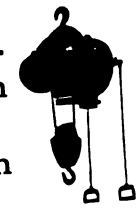
TEC TRUCKS

NORTHERN CRANES AND HOISTS

for labor saving service



A simple portable Electric Hoist like that below—"The Northern Type D"—can easily be attached to your hand power cranes and make them five times more productive in many instances—Northern Hoists are made in capacities from ¼ to 10 tons.



Alternating or direct current.

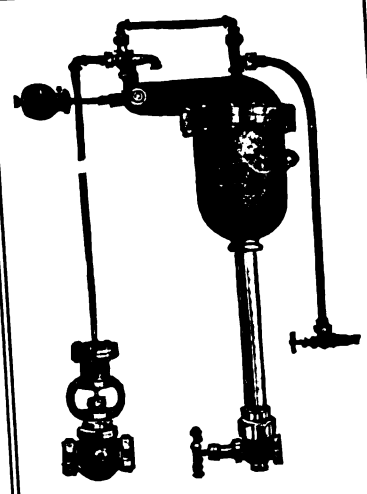
Our Circulars tell—Free on Request—

Northern Cranes from 1 Ton to 200 Tons.

Ask our prices

NORTHERN ENGINEERING WORKS

DETROIT, MICHIGAN



VIGILANT

Feed Water Regulator

WATER seeks its own level; and this principle is taken advantage of in the construction of the Vigilant Feed Water Regulator.

There are no tubes, floats or diaphragms to cause trouble; the action is entirely automatic, absolutely reliable and gives the greatest operating efficiency with a low fuel consumption.

The human equation—uncertain at best—is entirely eliminated. Set the Vigilant at the boiler water level you require and forget it. It responds automatically and promptly to all varying conditions.

Our catalog is yours for the asking

The Chaplin Fulton Mfg. Co.

28-36 Penn Avenue, Pittsburgh, Pa.

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Health, Production, and the Plant Plumber

(*Continued from page 16*)

of heating finds an excellent application. In these buildings, having large cubic contents and comparatively few men, the purity of the air is not affected very much by recirculating it. These unit heaters or space heaters are of various types, some being heated by steam with a motor-driven fan, some using steam to drive a turbine-driven fan, making use of the exhaust steam for heating and others being heated by gas or coal and having motor-driven fans. These units are also used as auxiliary heaters in severe weather when the regular heating equipment will not raise the temperature.

The best way to control the temperature of the various rooms in a plant is by installing a temperature regulator in each room. There are several of these on the market and the saving in steam will soon pay for them. Temperature regulators for controlling the temperatures used in various tanks, ovens, etc., in process work whether they are heated by steam, gas, or electricity, or cooled by ammonia or brine, are being used more and more every day and the wise manager will not permit this source of saving to be neglected.

In order to properly heat a plant, the radiation must be ample and a good supply of steam must be available. If high pressure steam is reduced in pressure for use in heating, a steam pressure regulator or reducing valve is used. The pressure regulator costs more, but has distinct advantages in that it will maintain the reduced pressure whether a large or small amount of steam is used. The reduced pressure is not changed by reasonable change in the high pressure feeder, if a pressure regulator is used, and the reduced pressure will not build up to the high pressure if no steam is being used. In mild weather when some of the radiation may be turned off, these points are especially important.

All steam pipes, whether they be mains or coils for radiation, should be lined up in order to avoid pockets. Large pipes are often carried on adjustable wall-brackets or supported from the ceiling. By using an anchor support at one end and roller supports at all other supports up to the bends or expansion joints, the pipe can expand without danger of loosening joints.

Pipe coil and cast iron radiation along the side walls should be supported by adjustable hangers fastened to the walls. In concrete walls, rails or slots or inserts imbedded in the concrete make adjustment easy. Return lines on gravity heating systems should also be lined up to avoid pockets. It is often necessary to run a return line under the floor at a doorway and unless this is properly done, it will form a water pocket. The sketch (Fig. 1) shows a method of venting return lines which must be depressed in this manner. The vapor pipe over the door should be half the size of the return pipe in order to work well. It is also suggested that tees be used at the ends of the depressed section, so that the plugs can be removed and the line cleaned out occasionally.

The packing on valves controlling steam dries up, and valves



Use Alundum Tile and Treads Wherever There is a Slipping Hazard

The first Norton Floor development was a tile consisting of Alundum abrasive grain and a vitrified clay bond. It is known as Alundum Safety Tile. The toughest of all abrasives gives this floor product longer life than any other floor material, and a non-slip surface.

Then came other developments—vitrified Alundum aggregates and marble chips using cement as the binding factor are combined to produce a great variety of color effects in both tiles and precast treads. Alundum Aggregate Tile and Treads have found a place in the finest of modern buildings in association with the most beautiful marbles and other materials. They can be produced in color combination to match the surroundings.

Where the small mosaics are preferred the slipping hazard can be eliminated by the use of Alundum Ceramic Mosaics. They are finding their place around the swimming pool, under the shower bath, in the wash room and kitchen and at the building entrance and lobby.

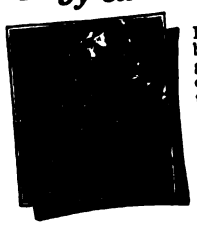
There is a Norton floor for every place where long life and a non-slip surface are essential.

NORTON COMPANY
Worcester, Mass.
New York Chicago Detroit Philadelphia
NORTON COMPANY OF CANADA, LIMITED
Hamilton, Ontario

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Make furnace walls last longer...

— by eliminating this!



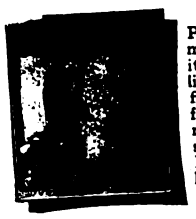
If you have fire brick linings they go bad quickly once the joints—the weak spots—give way. Bricks crack; the wall bulges; relining is necessary. Eliminate this.

— and this!

Front door arches, too, soon need repairing if made of brick. Heat attacks the joints. The joints, then the bricks, go bad after only a few months of service. This, also, can be eliminated.



— install Plibrico!



Pounded in with mallet and trowel, it forms a jointless lining that outlasts fire brick two to four times. It has no joints. Withstands 3100 deg. F. Cuts down heat loss.

— anyone can do it!

You don't need skilled masons to install Plibrico. Any man about the plant can do it. A mallet, a trowel and a desire to end furnace trouble are all that are needed.



— get walls like this!



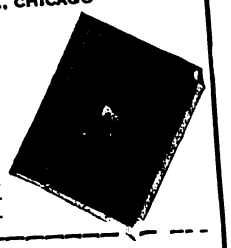
This Plibrico wall at the Otis Bldg., Chicago, is four years old. Have you walls as old that are good for as much more service? You will have if, next time, you reline with Plibrico.

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Stocks in principal cities.

PLIBRICO
FURNACE LINING
REG. U. S. PAT. OFF.
JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

Get your FREE copy

"Refractories and Furnace Design" will point the way to longer furnace life. Send the coupon for your copy.



Jointless Fire Brick Co., 1154 Clay Street, Chicago — Ind. Hl'd 2-24

Send me, free, my copy.

Firm .....

Address .....

.....

Att'n .....

should be repacked at least once a year. There are on the market several packless radiator valves that make for economy of maintenance on this item. Most globe valves may be fitted with new discs when the old ones are worn and re-seating machines are used when the seat is not tight. Another type of re-seating machine is used on gate-valves. On small and medium sized lines screwed unions with a metal seat are generally used. On the larger sizes, flanges with gaskets are used.

A great deal of steam is carelessly wasted by using traps which do not work right or by not using traps at all. Radiator traps are different for the various systems and should be carefully chosen to fit in with the rest of the return line equipment. Some systems use return traps delivering to a direct return trap that puts the water back into the boiler. Condensation pumps are used where the return pipes are at about the level of the boiler water and can often be used to make an otherwise sluggish system work. Vacuum pumps by producing a pressure less than atmospheric pressure in the return lines will draw the condensation back to a hot well.

From the standpoint of economical maintenance, the savings which can be effected by the judicious use of pipe covering, are everywhere apparent. A direct saving in fuel will repay the investment for insulation of pipes and other heated surfaces in a short time. The only reason that some of these losses are allowed to continue is the fact that the management does not realize how great they are. The question of the advisability of insulating must be determined by the engineers after a thorough study of conditions. For low pressure steam lines and hot water lines, a rather low-priced insulation, such as an air cell asbestos covering, is often used. The selection of the type of material to be used can only be made after all considerations have been carefully weighed. These include items such as initial investment compared with the saving made, permanence of the job, etc. There is a point in insulating expense, where the possible savings are not commensurate with the outlay and the money spent on better or thicker insulation will not be well invested. However, this point is rarely reached in plant work.



At Your Service

INVENTORS and builders of small motor driven tools and machines—confronted with perplexing power problems—are invited to take advantage of the services of our Engineering Department.

This department has for many years been in close contact with the uses and application of small motors. Their experience is offered to you as a help in the working out of your own problems.

We will gladly co-operate with you in the building of a *better* product. Do not hesitate to call on us for advice. Our combined efforts will, perhaps, result in another appliance being made more saleable and more dependable because it is equipped with a motor that is exactly adapted to its particular job.

Wisconsin Electric Company
7067 Sixteenth St., Racine, Wis.



Type-A—Stripped
⅓ h. p. Cast iron frame, enamel finish. Babbitt bearings, wick oil feed. Operates on A.C. & D.C.



Type-D
⅛ h.p. Cast iron frame. Enamel finish. Plain bearings. Grease cups. Operates on A.C. & D.C.



No. 3GM—Stripped
¼ h.p. Aluminum frame, enamel finish. Normal bearings. Ventilated. Operates on A.C. & D.C.

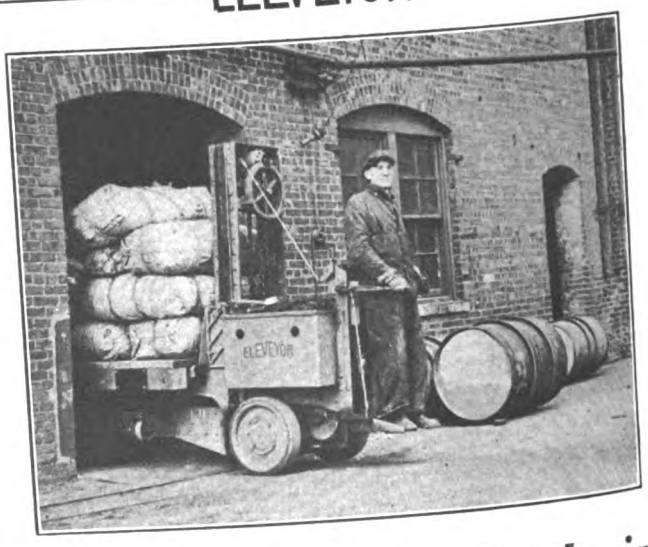


Type-SAX
Motor 1/25 h. p. Special base.

DUMORE

FRACTIONAL H.P. MOTORS

ELEVEYOR



The ELEVEYOR (3 Trucks in 1) Saves 66⅔% in Handling Costs at this Plant



Write for Catalog

Here is another example of how the ELEVEYOR—the Truck that conveys, elevates and stacks material—saves in handling and storing costs.

In this plant (name on request) the ELEVEYOR has not only effected savings in the storing of raw materials, but has actually cut handling costs 66 2/3%.

We have a practical plan whereby we can prove the economy of ELEVEYOR Trucks, right in your own plant. Let us tell you about it.

ELEVEYOR INDUSTRIAL TRUCK CORP.
56 Huntington Street — Brooklyn, N. Y.

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One usually finds not enough insulation rather than too much. The laminated or air cell asbestos coverings are not recommended for temperatures above 400° F.

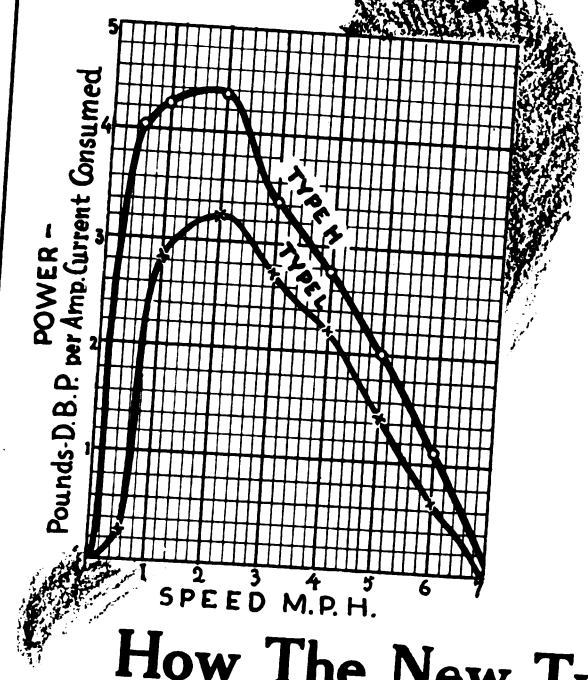
For main steam lines eighty-five per cent. magnesia is recommended. This is made up of eighty-five per cent. of magnesia and fifteen per cent. of asbestos fibre, as this proportion has proved best by experience. This covering is used in most power plants on main steam lines because it is universally considered the best insulation for this work. It is very efficient and is strong and light in weight. It is used on temperatures up to 750° F., above this point a high temperature insulation is used.

In order to prevent damage to machinery or goods in process, due to condensation dripping from cold water pipes, a wool felt covering is recommended. Outdoor water pipes, such as exposed pipes down from sprinkler tanks, should be protected with several layers of hair felt, the number depending on the severity of the climate. Usually a layer of tar paper and three layers each of hair felt and builders' paper are used with a jacket of canvas sewed on outside. On outdoor steam and hot water lines, the thickness of the usual covering should be increased and a layer of waterproof paper applied. The canvas jacket should be painted with a coat of sizing and two coats of oil or asphalt paint. Underground steam and hot water pipes require special protection. Oftentimes the expense of a pipe tunnel is not justified and the pipes must be laid in the ground. If the ground is wet, a drain should be laid with loose rock around it about a foot below the grade of the pipes to be insulated. Several systems of underground insulation are available, the main items to be taken care of are roller supports for expansion and waterproofing and protecting the heat insulating covering. One system makes use of a tile-protecting member that is filled with insulating material. Brine and ammonia lines are insulated with cork covering two or three inches thick or with built-up felt consisting of several layers of felt sealed with asphalt. The sealing is important so that moisture will not accumulate between the pipe and covering and freeze there, causing the covering to break.

Most modern plants are equipped with an automatic sprinkler system. However, there are frequently portions of old plants not so protected. The cost of this protection is quickly repaid by reductions in insurance premiums and it is therefore poor business policy to have unsprinklered buildings. It is quite important that the correct sprinkler heads be used in places subjected to high temperatures in the normal manufacturing process. It is necessary to get authority to use these high temperature heads, but they should be used in furnace rooms and other hot rooms to avoid danger and damage that might be caused by a head letting go not due to a fire. There is also the danger of freezing in monitors and other places exposed to the cold. Oftentimes authority can be obtained from the insurance company to shut off sprinkler lines in monitors during the winter. For unheated spaces, like sheds and pattern storage rooms, a dry pipe system is recommended. In this system a

(*Continued on page* 65)

Specify the Tractor with Reserve Power



THE new Mercury Type-H electric tractor has 25% to 40% greater power for a given speed and current consumption than the best of the worm driven models. See the graphic illustration of this big advantage in the accompanying curves. We have the complete data to back up these curves.

This reserve capacity enables the new tractor to pick up extra trailers when needed, to pull up a steep grade that would balk an ordinary tractor, or to work overtime without exhausting the battery. This naturally results in lower operating cost.

Any machine will operate more economically if it is not being continuously pushed to the limit of its capacity. The reserve power in the Type-H therefore means not only lower operating cost but also reduced maintenance expense and increased dependability.

How The New Type-H Makes This Possible

Introduces a balanced internal gear drive of entirely new design, eliminating the friction losses inherent in the worm drive. This results both in low operating cost and an absolute minimum of upkeep for the "power plant."

Retains all valuable features developed in previous Mercury models including:

1 Special safety features effectively insuring against danger, even in the hands of inexperienced workmen.

2 Drum type controller of special design having long life, dependability, simplicity, ease of inspection and adjustment.

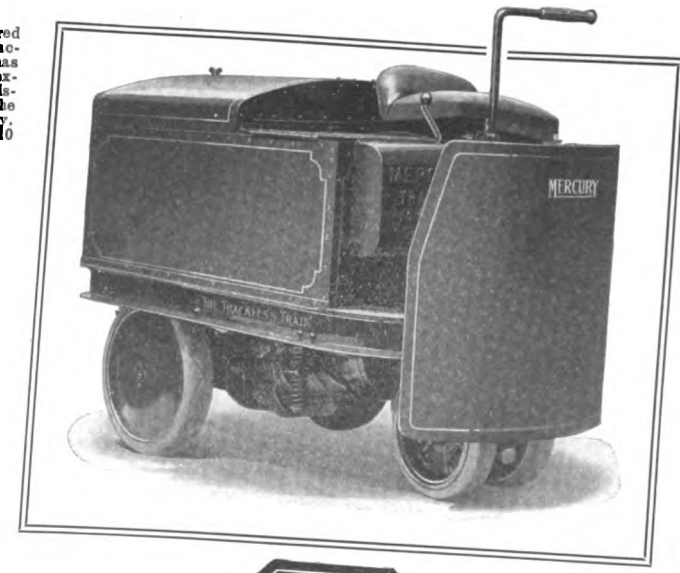
3 The exclusive Twin-3 front wheel assembly combining full spring suspension with the short turning radius of older 3-wheel models.

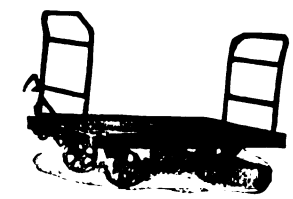
4 Frame of channels and angles hot riveted to combine maximum simplicity, rigidity and strength.

Fleet Owners

The Mercury organization pioneered in the field of electric industrial tractors, and for more than 8 years has made such tractors and trailers exclusively. It is therefore not surprising that a preponderance of all the large installations are 100% Mercury. A few of the large fleet users (over 10 machines) are the following:

American Railway Express Co.
American Radiator Co.
Armour & Co.
American Window Glass Co.
General Electric Co.
Endicott-Johnson Co.
United States Government
Studebaker Corporation
Sugimure Warehouse (Japan)
Willys-Overland Co.
American Car & Foundry Co.
Kewanee Boiler Co.
Eastman, Gardiner Lumber Co.
Standard Oil Co.
Union Stock Yards & Transit Co.
Pennsylvania Railroad Co.
Sears, Roebuck & Co.
Illinois Central Railroad
Lehon Co.
Morris & Co.
Swift & Co.
Miller Rubber Co.
Chicago Tunnel Co.
Chicago Union Station Co.
Chicago Burlington & Quincy R.R.
New York Central System





Trailers

And to complete the "Trackless Train" there are Mercury trailers of just as distinctive merit as the tractor. There are various designs for special purposes, but the A-310, illustrated above, is an all-purpose trailer which meets most all ordinary industrial conditions.

Mercury Manufacturing Company

4112 South Halsted Street — *Chicago, U. S. A.*

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THEY RIDE BOTH WAYS ON A-F CONVEYORS

Shop transportation after all, is the determining element in maintaining production schedule and insuring maximum output. That, then, is the reason why so many manufacturers are giving more and more attention to transportation facilities and that's why you'll find A-F Systems of conveying in so many plants.

The installation here pictured is typical of A-F efficiency. The Apron conveyor carries the empty boxes from the storage room up to the Parking Room. When filled with coffee they return by the spiral chute and are ready for shipment. Not a single man is required, not a motion is wasted—and the total cost of installation, upkeep and operation is but a fraction of the truck and elevator way.

A-F Conveyors are not only more economical but they're more convenient and more dependable. They utilize the waste room—they go everywhere—they're always on the job and they require almost no attention. Products of every description ride them for they are adaptable to every need.

Unless your shop transportation can't be improved it will pay you to find out about A-F equipment. Write now for information.

The ALVEY-FERGUSON CO., Inc.
Cincinnati, Ohio



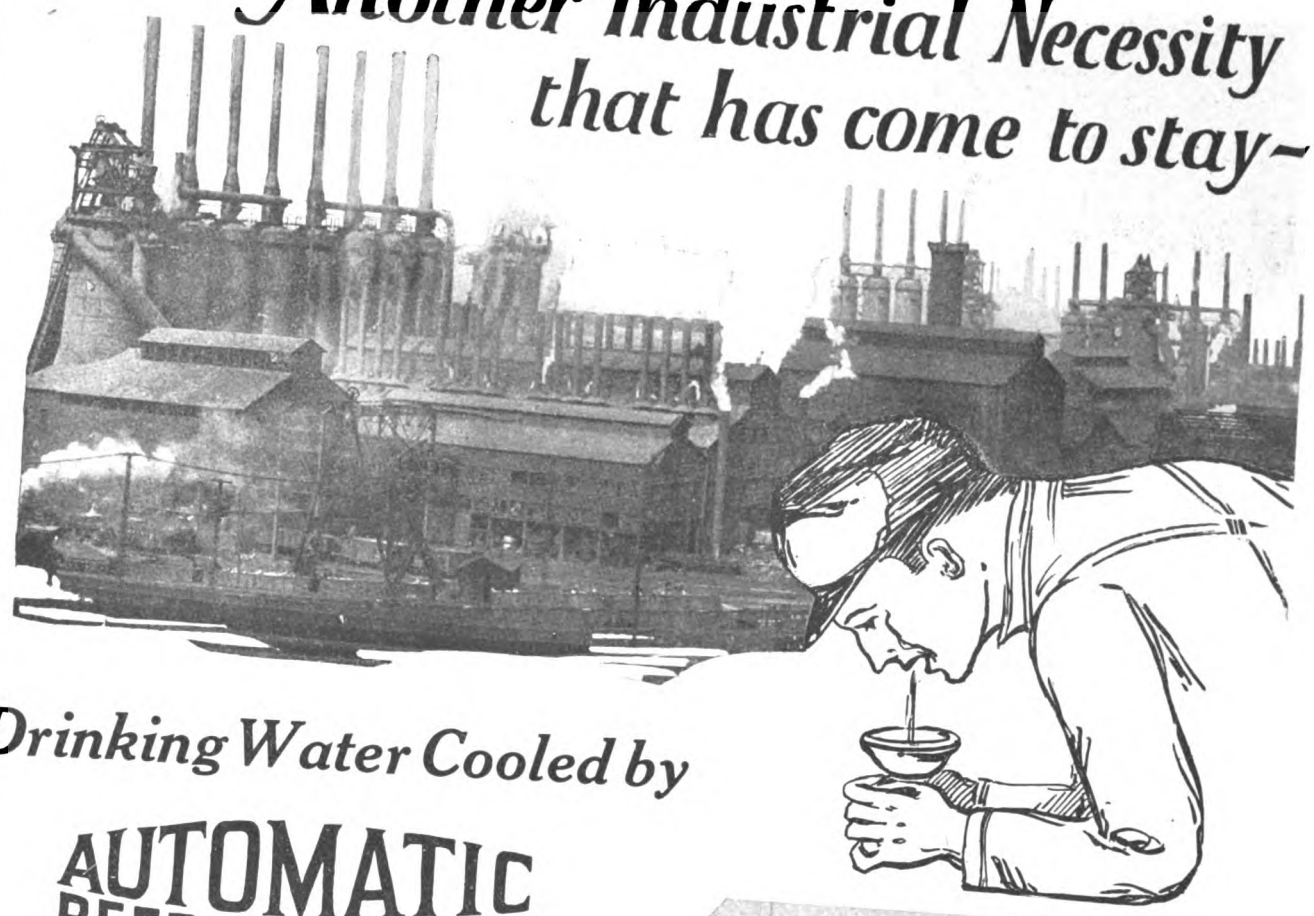
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(*Continued from page 63*)

large special valve is necessary. This valve admits water to the lines as soon as a head goes off. Valves on sprinkler lines should be sealed open or shut as indicated and it is a good idea to have enameled signs at each valve listing the rooms or buildings it controls. These signs should also be hung on the indicator posts in the factory yard. Hydrants should be located at strategic places, such as junctions of two roads, so that hose can be carried in several directions. A minimum amount of hose should be coupled to the hydrant and be carefully coiled or folded so as to be easily pulled out without tangling. The hydrant houses should contain all the necessary fittings, wrenches, lanterns, nozzles, etc., at all times. All underground sprinkler pipes should be of cast iron, with joints of lead, well caulked. They should be buried in the ground at least six feet in cold climates and hydrants and indicator posts should be long enough to be set at the correct height above ground. It is necessary to have an elevated tank of a capacity large enough to take care of a fire lasting several minutes or else have another source of supply besides the city service, such as a river or pond or artificial tank with connections to a fire pump. Sprinkler tanks are of the plain gravity or pressure types, sometimes both are used. With the pressure system air pressure is applied above the water level in closed tanks. All tanks exposed to cold should be heated by steam coils inside the tank. These are usually placed inside the tank near the bottom and near the sides of the tank. The steam riser and return should be run alongside the discharge pipe and be insulated as previously mentioned. It often happens that a small fire during the night causes more damage by water than by fire unless the water is shut off after the fire. If watchmen are not available, this service can be had in most of the large cities. These patrol services get the electric alarm in their office when a sprinkler head goes off as this reduces the pressure on the system and they send men to cover up merchandise and machinery, shut off the water when the fire is out and put in new heads and turn on the water again. With a trained crew of night watchmen, this same work can be done.

Much that has been said above regarding steam pipes, valves, and fittings applies equally as well to air, gas, oil, water, and drain pipes. Hydraulic and ammonia lines require special fittings and extreme care in making up the joints. Elbows on hydraulic pipes should be braced to reduce vibration caused by quick changes in pressure. Leaks of any kind should not be tolerated. Besides the direct loss of the leak itself, there is the damage to goods and equipment as well as depressed morale of employees if they feel that the management does not seem to care about things of this kind. For packing flanged joints, the correct packing for the particular service should be used. If the responsibility for leaks is put up to the pipe-fitter foreman, it will in time have its effect by his insisting on first class work from his men. The most frequent leaks in a plant are in the compressed air lines because the men mistreat the valves. Spring valve nozzles are now used almost exclusively to reduce leaks, but the average

Another Industrial Necessity that has come to stay~



Drinking Water Cooled by

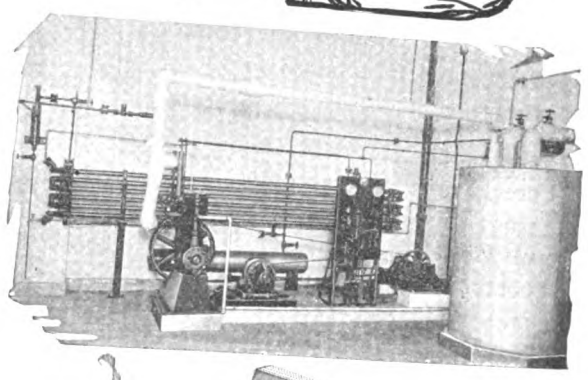
AUTOMATIC REFRIGERATION

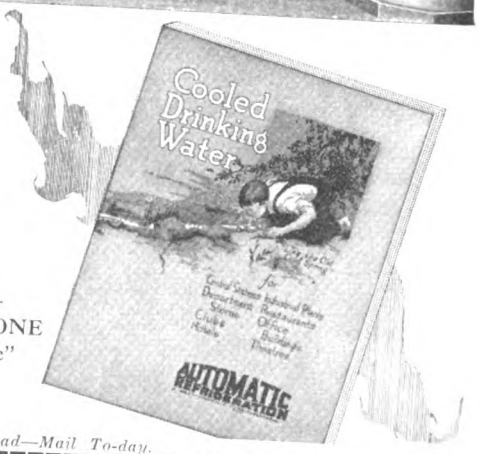
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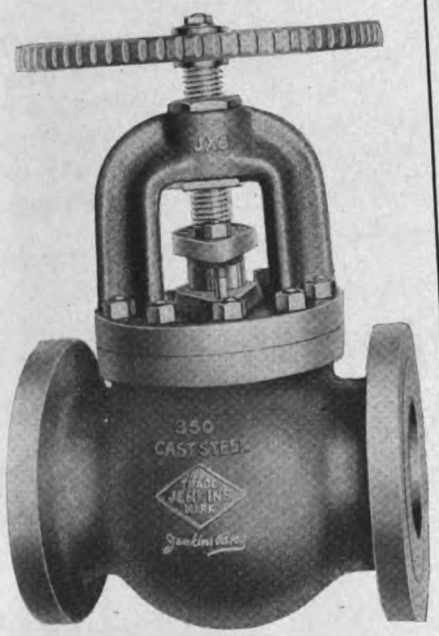
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employee thinks that air is cheap and an educational campaign is necessary to make him realize the cost of compressed air. Gauges and thermometers on pipe lines and tanks should be located so that they are not apt to be hit or broken off, they are indispensable and they should be accurate and dependable. Pipes for vacuum cleaning systems should have tight connections which can be plugged into. These are usually brought out near the floor line. Steam for process work and for such heating jobs as soda kettles, metal washing machines, etc., should be on separate lines from the heating system so that only the small pipes necessary for this work need be used in summer. Plating rooms also should have their cleaning tanks heated from special supply pipes. For heating jacketed kettles or open tanks, where a high rate of heat transfer is required at temperatures above those of saturated steam, a heated circulating oil system is often used. In this system the heavy oil is circulated by a pump through a heat absorber and then to the tank to be heated. Temperatures up to 600° F. may be used with heavy oil. When a number of pipes are run underground from one building to another, a pipe tunnel is desirable. Pipes may be hung on brackets on both walls and from the ceiling, if necessary. The tunnel should be waterproof and large enough to allow a man to walk through. Pipes buried in the ground are hard to get at if something goes wrong and the tunnel is therefore almost a necessity if important pipes are carried in it. If only a few small pipes are needed a hardwood box of rough lumber about twelve inches square can be made with a loose cover, and if its location is charted, it can easily be found when necessary.

The work of the plumbers is very closely allied with the pipefitters, and in plant work it is not uncommon to have men who are able to do both jobs. The sanitation of the toilet rooms is so important that every effort should be made to keep them in repair. Toilet bowls that are cracked or chipped are breeders of disease and should be replaced at once. The urinals that are considered best are the high porcelain stalls and they are fast superseding the small urinals just as the individual toilet bowls have made practically ob-

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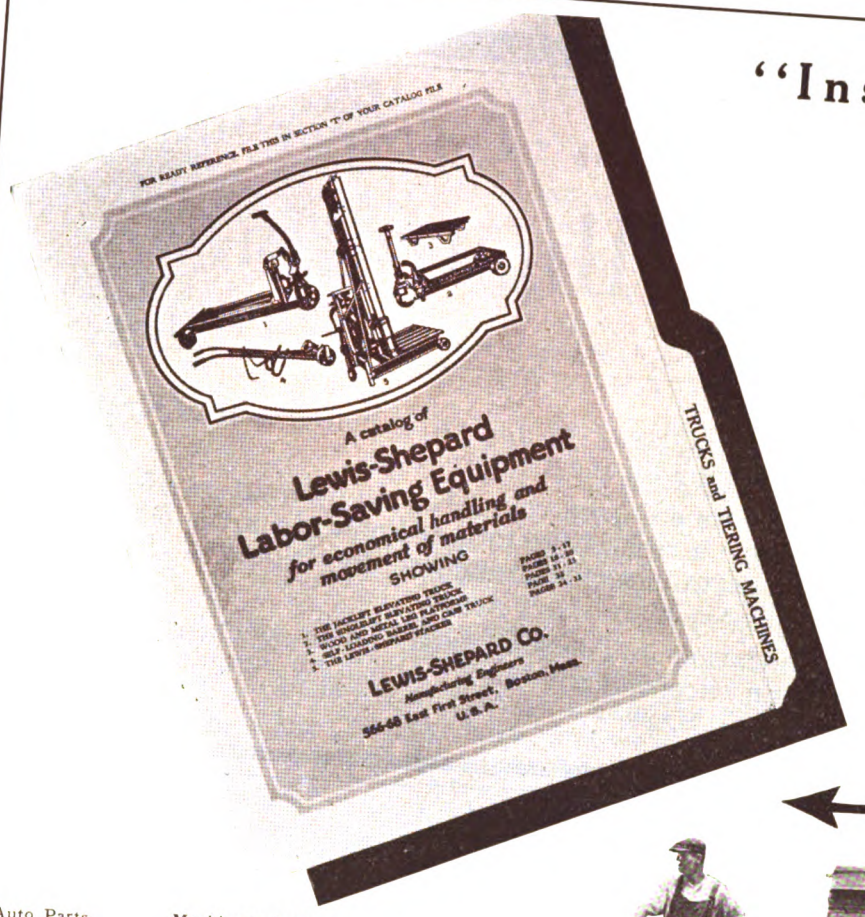
This is part of a letter from the General Superintendent of a large Chicago concern. Write for Power Plant literature.

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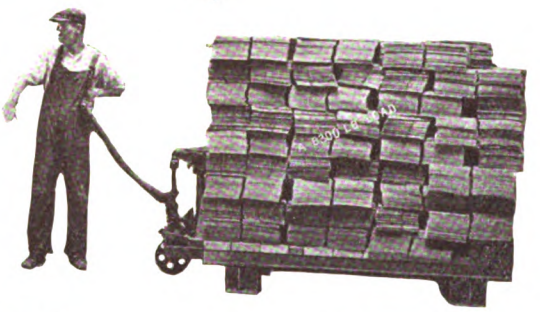
solete the old range closets. The desire for individual toilet accommodations is shown by the individual wash bowls, which are coming more and more into use. In some plants each worker has his own wash bowl. The long double wash sinks with faucets in the center accommodate a great many more men for the same investment and the newer round wash fountains also accommodate a great number of men. Both of these give each man clean running water and are therefore sanitary. In places like foundries, where the men get very dirty, shower baths should be provided. A hot water heater, with a thermostatic control or a hot water mixer, is necessary for shower baths. Bubblers or drinking fountains should be installed in every room. These may be of the wall or floor type. If they are iced, the floor type is used. If refrigeration is available, circulating iced water will do away with the labor needed to ice the coolers once or twice a day. Drain pipes inside the building should be of cast iron with joints of lead and well caulked. Outside of the building underground they may be of tile. These drain and sewer lines are very important and should be laid to grade so as not to pocket any water.

Mechanical ventilation is gradually being used more and more in industrial plants. It has been used for a long time for drawing out poisonous fumes and dust, but it is gradually being realized that fresh air is worth money by removing the tendency toward drowsiness, which the men have in badly ventilated rooms. The usual ventilating systems clean the incoming air by washing, humidify and heat it and deliver clean tempered air for the men to breathe. This washing and humidifying is done by water jets, the usual method being to wash the air first, then heating it to the desired temperature. Air at high temperatures will carry more moisture than at low temperatures. It is quite obvious that the air can be pretty well saturated at low temperatures and then heated and at the higher temperature have less humidity. In this way it is possible to control the humidity. In order to obtain the best ventilating effect, the air supply should be large in volume and comparatively low in temperature. This requires larger fans to move the larger volume of air, but it has been proved by experiment that this way is much better than using a small volume of highly heated air. The advantages of heating by the indirect or ventilating method naturally cost more in the initial investment, but in order to get real ventilation a mechanical system is necessary. A lower temperature can be maintained if the humidity is increased and in this way it may be said that humidifying pays on savings in fuel. This humidity should be kept within the limits mentioned in order to be comfortable. Too much humidity produces a sticky feeling and is apt to make the men feel drowsy. The method of washing, humidifying, and heating the air is called air conditioning and this term very well describes it. These systems often have arrangements to recirculate some or all of the heated air, especially during the warming up process in the morning. The air ducts are usually carried along the ceiling near columns or walls with outlets at convenient locations. These ducts interfere with other equipment, such as shaft-



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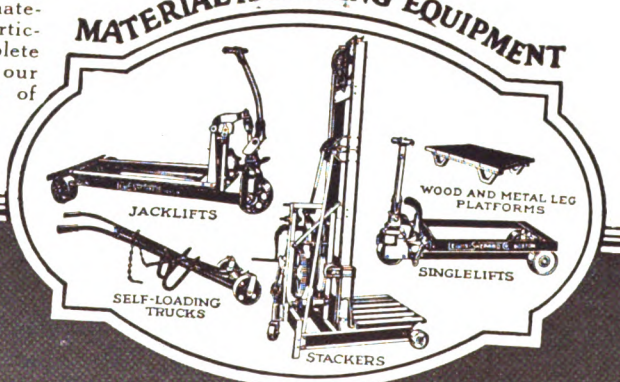


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ing, etc., and in new concrete buildings hollow columns are sometimes used as ducts. Usually the outlets are made Y-shaped in order to reduce the velocity of the air by doubling the size of the outlet suddenly. This should slow the velocity of the air so that the employees working near the outlets will not feel any breeze from them. Sometimes large main ducts are built of concrete under the floors and these should be kept dry. They will also absorb some heat during the warming up period. Ducts should be of a sufficient thickness galvanized iron to hold their shape and they should be securely fastened. Dampers should be provided so that even distribution may be had. Very little maintenance work by the tinsmiths should be necessary on the ducts.

Exhaust systems are required by most states on polishing, woodworking, and sand-blasting equipment, and a minimum suction at the hoods is usually specified. The hoods on polishing wheels should have a trap at the bottom for cleaning out heavy particles falling down when emery wheels are used. The piping should be correctly designed in order to give an even suction all over. The dust collectors are often on the roof and should have a cleanout can at the bottom so that they can be cleaned out every day while the system is working. The systems used for woodworking machinery should be capable of handling the sawdust and shavings produced. As the modern machines produce more shavings than formerly, the exhaust systems will have to be changed to take care of the increase. The wear and tear on these systems is much less than on polishing or sand-blast systems, where elbows wear out and have to be renewed. The lining in the dust collectors can be renewed and if this is taken care of, they will last a long time. These pneumatic systems are also used for conveying materials and this method of handling is very economical. Ventilators of the suction type are used on roofs for drawing out air, dust, and fumes. These require no power to operate them and a slight breeze is enough to make them pull.

The tinsmiths usually make the guards for the machinery. These are usually built on heavy wire or angle iron frames with wire or expanded metal as protection. These guards may be made to conform to insurance companies' specifications and thereby gain a small reduction in the premiums, or they can be made to guard against the average accident. Gear guards on machines are sometimes made solid of galvanized iron as they can be fitted closer to the machine. Splash pans for machines using lubricants are usually made of galvanized or black iron. They should be carefully made and should not interfere with the operator. Outside leaders and gutters and tin roofs are in need of continual care by the tinsmiths and they should not be neglected.

In the pipefitting shop, there should be power-driven pipe-cutting and threading machines and a complete set of pipe dies and small tools. Supplies should be drawn from the maintenance stockroom as needed and small amounts only kept on hand. There should be steel pipe racks at a convenient place and small bins should be provided for the few fittings carried. There should also be a motor or gas engine driven pump, mounted

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a truck, for pumping out pits or basements in case of a leak or heavy rain causing water to back up.

It is very important that there be maps of all piping, especially underground piping. Records should be made of all changes, repairs, and replacements and the maps kept up-to-date. An inspection system is necessary and these reports together with the records of repairs give valuable data for future use.

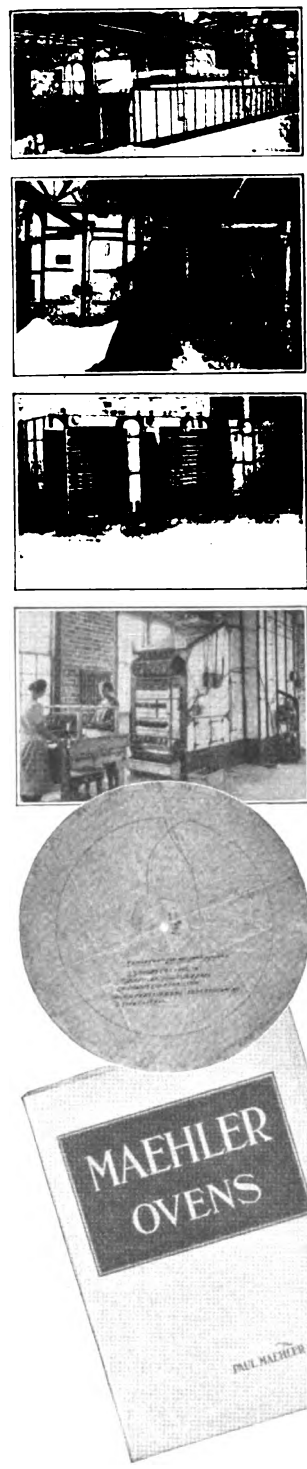
There has recently come in from the four corners of the United States the story of general business conditions, told by those who are on the spot and know whereof they speak. The dominant note is that of a sound and healthy conservatism which seeks to see more clearly before it ventures far into a somewhat uncertain future. Only occasionally is there alarm or pessimism manifested, and then it is invariably the result of poor local conditions.

Throughout the country there is everywhere a growing sense of obligation and responsibility on the part of common people for the welfare of the nation. The great mass of the people have not lost their grip, even though some superficial observers may say that they are dragging their anchors.

Some business men are inclined to be a bit pessimistic over the fact that 1924 is a Presidential election year. They entertain a loose traditional idea that all such years are naturally bad for business. This year, however, there already are some indications that the sentiment of the country in general is tending to crystallize into definite expectations concerning the outcome of. both the nominating conventions next summer and the election returns next fall. It appears now, therefore, that this element of uncertainty in the general situation during 1924 will be less of a major factor in shaping business conditions during the year than it has been in some other election years. There is no doubt, however, that uncertainty as to the outcome of the election will be sufficient to have some influence in maintaining the conservatism that has characterized business as a whole during the past half year or so. —*La Salle Extension Bulletin.*

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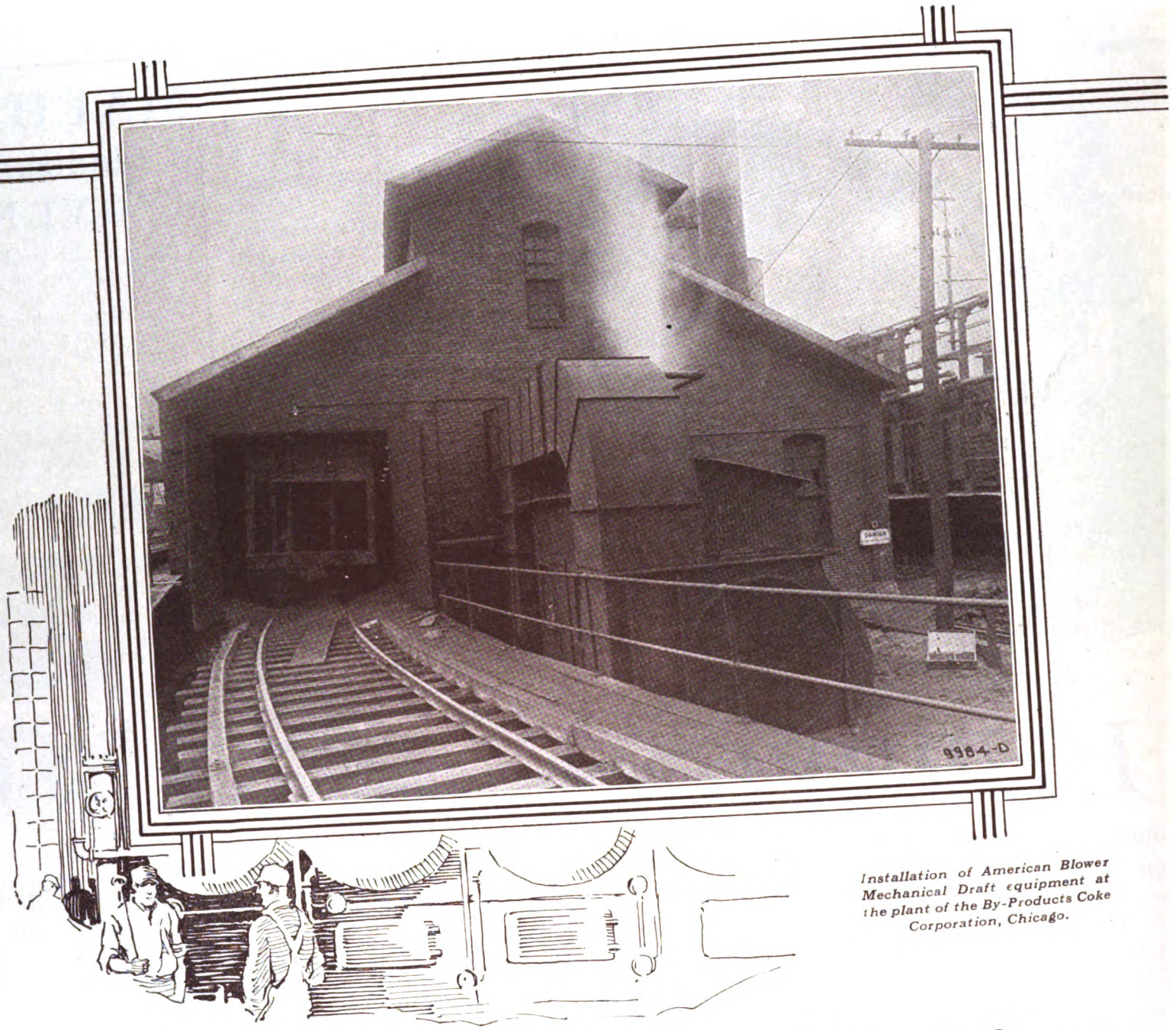
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American Blower Mechanical Draft Saves $88,200 a Year

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"When we added 2 units to our auxiliary boiler house in 1911, we installed an American Blower forced draft system. This consists of 2 steam driven fans, one being used as a spare. At present, this equipment supplies air to 6-400 H. P. hand fired boilers, and because of the excellent draft we can burn fine coke breeze very satisfactorily.

To get the same capacity with natural draft, we would have to burn coal, which costs $3.50 a ton more than fine coke breeze. Therefore, the American Blower system saves $88,200 a year in fuel cost. It also saved the cost of the higher stacks which would probably have been required to create satisfactory natural draft.

We are also using 4 American Blower fans for handling hot gases from our coke ovens. This enables us to generate 1000 boiler horse power for every pair of fans.

The American Blower equipment was chosen because we were convinced that it would give good service. It has been very satisfactory and we have experienced no mechanical troubles. Under similar conditions we would repeat our orders.

The manufacturers furnish first class service, a highly important consideration in the choice of any equipment."

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Planning the New Factory Building

(*Continued from page* 13)

tion of one process to the next will not be very close. For instance, in our pencil factory, the woodworking machinery will have little relation to the graphite preparing equipment, or to the ferrule and eraser units. All of them, however, come together in the assembly unit. These distinct groups become departments, and may occupy separate sections of a one-story building, separate floors in a multistory building, or even separate structures.

Suppose our hypothetical pencil plant requires around 5,000 square feet in our woodworking department, 3,000 feet in the graphite department, 2,000 feet in the ferrule department, 2,500 feet in the rubber department, 2,500 feet in the assembly room, and 5,000 feet for general storage, shipping, and offices. This would suggest a four-story building of 5,000 feet to a floor, one for woodworking, another for graphite and ferrules, a third for rubber preparation and final assembly, and the last for storage, shipping, and administration. Thus the general arrangement of the plant begins to shape itself, modified, of course, by other factors, such as the area and value of the available land, the need for light, and the special requirements of unusual machinery or process equipment.

Where land values are low, the choice of a one-story as compared with a multistory building, will have to be made with care. The high building needs stairs, elevators, and fire-escapes that are non-productive. The one-story building requires more roof and foundation wall, but under some circumstances may actually cost less per productive square foot of floor space. High land values, of course, indicate multistory structures.

Consideration should be given at this stage to the question of a standard type versus a special kind of building. By standard type we simply refer to a building of such character as to make it suitable for other industries, in case it became necessary to sell the property or convert it to other uses. Normal floor loads, normal ceiling heights, and normal column spacings, make a building more readily marketed if a change should become necessary, and consequently increase its sales value. On the other hand it is quite possible that the requirements of the business for which the structure is first planned are best met by major deviations from such normal or average dimensions and strengths. The ultimate advantages of the standard versus the special should be carefully weighed, and a decision reached as to which is likely to be the most profitable.

In a case recently under the writer's control, an automobile body plant making steel bodies had machines in certain departments requiring much greater ceiling heights than the machines used in other departments. Balancing the need for special space requirements against the advantages of convertibility, resulted in designing the six story concrete building with a different ceiling height for almost every story, the extremes being approximately 21 feet from floor to floor in one instance and a normal 14 feet in the minimum floor.

Now we come to the detailed planning of the building. All important matters of policy and arrangement have been settled, "in principle" at least. It is generally wise not to establish the requirements too rigidly, as some deviations from the ideal may prove entirely practical and at the same time effect important economies in construction. Up to this point the owner and his staff have been working (or should have been working) in close coöperation with their chosen architect and engineer and his staff. Each has knowledge required to discover and analyze the facts needed in establishing these matters of policy and general arrangement. Either group working alone would in all probability find itself guessing at important matters that the other could establish with sound judgment. Either working alone would produce an incomplete conception, and the resulting structure would ultimately show errors and omissions likely to be distressing and costly.

Now, however, the architect and engineer (using the two terms together to indicate a coordinated staff of men trained in all the branches of each profession) can work out most of the remaining details. Nevertheless, to carry the whole process through to the end, we will continue this analysis to show

(*Continued on page* 73)

Stop Shoveling

WHERE you used to pay dollars for hand shovelling you can do the same work for dimes with a Haiss Portable Belt Conveyor or Truck Loader. It's the economy way to stack and reclaim Coal from ground storage. And the equipment is flexible—you can use it anywhere for any other handling job.



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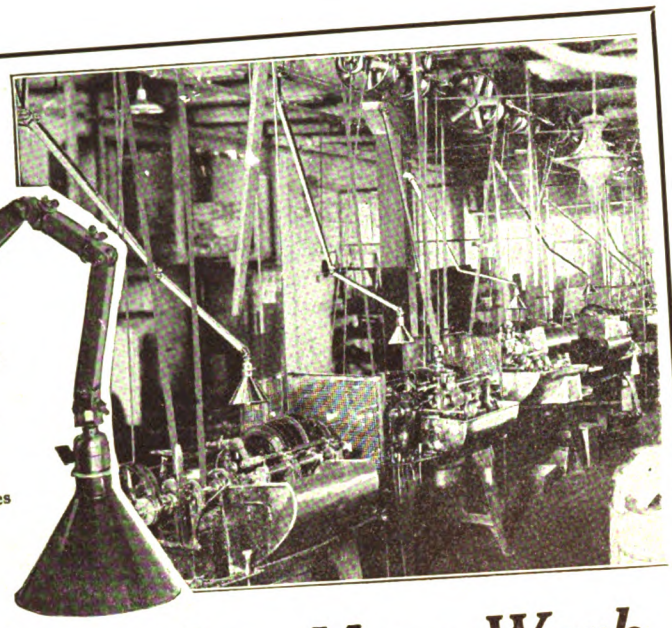
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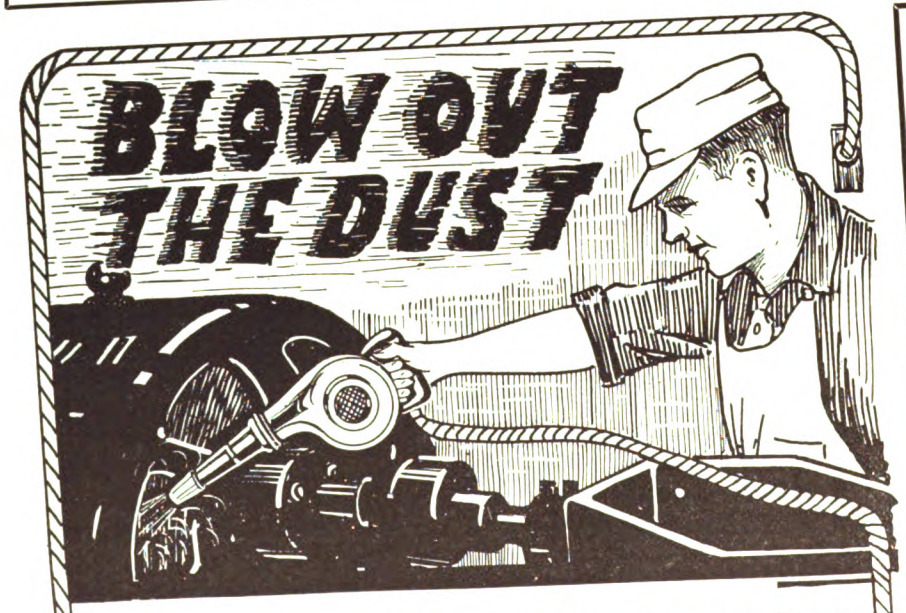
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The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc.

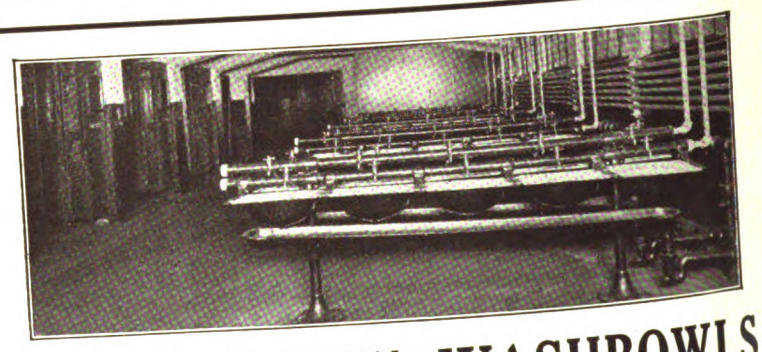
Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

Weighs only 6 lbs. Complete in itself and requires no expensive installation or equipment. No condensation as with compressed air. Attached to any light socket.

The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories, and every line of industry.

Write for descriptive folder giving prices and testimonials by leading manufacturers.

CLEMENTS MFG. CO.
Manufacturers of the Cadillac Electric Vacuum Cleaner
612 Fulton Street, Chicago
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MEECO INDIVIDUAL SANITARY WASHBOWLS

Were designed especially for factories to provide a sanitary, efficient washing-up apparatus at a moderate cost. They have displaced the open sink, the common trough and other unsanitary methods of washing-up and have been pronounced by many authorities the ideal factory washbowl, whether the plant employs 50 or 5,000 men. They are ruggedly built, simple in construction, easy to install and eliminate high plumbing expense. They are space-savers and take up no more room than common sinks.

A few of the prominent firms who are large users of MEECO Individual Sanitary Washbowls:—Amoskeag Mfg. Co., 1000; Bethlehem Shipbuilding Co. (Fore River Works), 1000; Central of Georgia R. R., 1000; Colt's Patent Fire Arms Mfg. Co., 3200; General Fire Extinguisher Co., 1200; New Departure Mfg. Co., 1600; Pratt & Whitney Co., 2800; Underwood Typewriter Co., 1000; United Shoe Machinery Co., 2400. The complete list of firms using MEECO Washbowls reads like the Blue Book of American business. 5000 companies in 200 lines of business have adopted them as washroom equipment.

They Are Really Sanitary

There is room enough at each bowl for every man to get a thorough, clean wash without crowding. The unsanitary and inefficient features of washing in a running stream are here obviated. There is no slopping over on other men. There are no half-way attempts to get clean. There is no waste of water. Let your men put the plug in, fill the bowl and clean off the grease and grime. They can't do it in a running stream.

Send Today for Catalogue and Price List

Shelving
Chairs and Stools
METAL MEECO PRODUCTS
Lockers
Drinking Fountains

MFG. EQUIPMENT & ENGINEERING CO.
FRAMINGHAM, MASS.

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(*Continued from page 71*)

how these data are used to develop the final plans and elevations from which the building will be erected.

Heretofore we have not mentioned the choice of structural materials for the building. Although this aspect of the problem is likely to be one of the first things considered by the owner when he starts thinking of new buildings, it is really a matter to be determined after all the other factors are known. In fact, the choice of construction could be left entirely to the architect and engineer, for it is their business to know what materials and methods will best meet the established conditions. Of course where the choice between several materials is optional, the owner's preference should govern; but if the owner fixes in advance the type of construction it may hamper the development of the most effective structure for the purposes in hand.

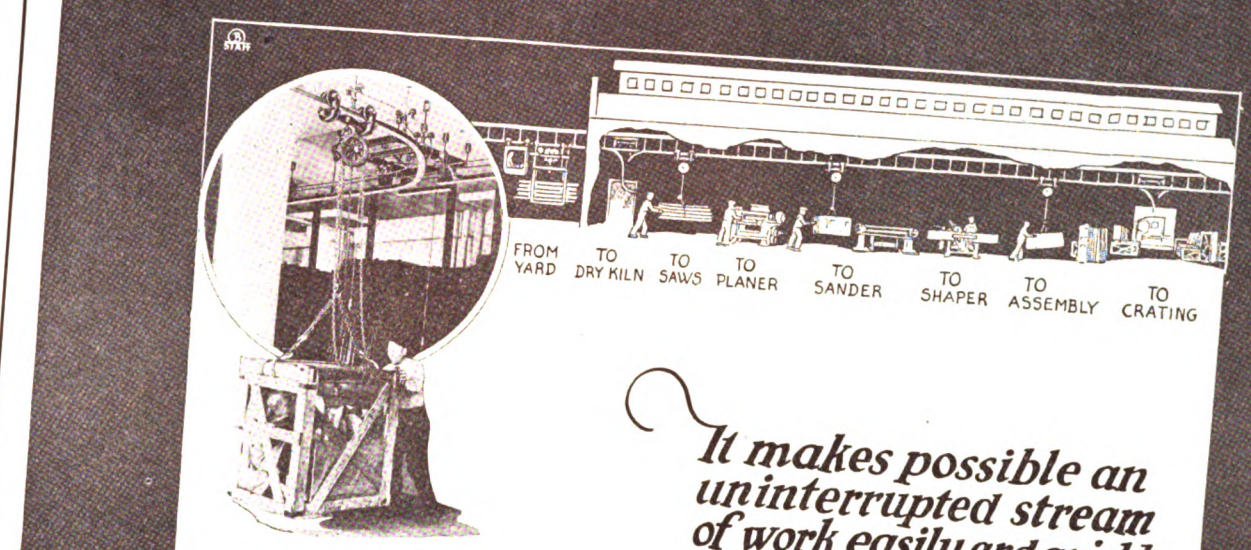
Assuming the choice is unrestricted, it will be found that the demands of the manufacturing process will indicate the materials most suitable for the building. For instance, while concrete may be the logical material from the point of view of permanence and fire-resistance, if the process be one that requires many apertures in the floors for piping, material conveyors, or for parts of the machines, it may be much better to use the old type "heavy mill" construction with wood plank floors, because such floors can be penetrated almost at will without much expense and large openings may be reframed as required. A paint and varnish plant for example, is one that finds a wood plank floor valuable for this reason, for many of the processes are connected by elaborate piping systems passing from floor to floor. If the building had concrete floors the rearrangement of the machinery when enlargements were made would entail great expense in cutting holes of various sizes from one floor to the next, for the reinforcing steel might be severed and the whole slab weakened.

The choice of brick walls as compared with concrete or hollow tile is governed largely by cost and appearance. Unprotected steel framing may be used safely in some structures, but in others would entail a great loss in the event of fire. So it goes with each material; there is a purpose and a place where one substance is superior to all others, and it is the designer's business to choose and use each one correctly.

To be more specific we may briefly outline the advantages and disadvantages of the principal types of construction. From this outline it will be clearly apparent that the choice of construction is governed largely by the purpose for which the building will be used.

Heavy mill construction uses large dimensioned wooden beams and girders with a wooden floor made of planks generally 3″ or more in thickness. Sometimes the columns are steel and occasionally some of the girders are of steel, but frequently wood is used throughout except for the walls. These may be of any material, such as brick, hollow tile or concrete.

This construction is called "slow burning" because the heavy wood members do not take fire quickly. Such buildings possess the following advantages: They are relatively



From rough lumber storage through every department and to every machine in the mill—even to the loading of finished material on to trucks or cars—***the Cleveland Tramrail can be arranged to save thousands of dollars yearly in material handling costs.***

Besides saving man power and labor—it speeds up the movement of lumber from one machine or department to another.

CLEVELAND TRAMRAIL SYSTEM

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It makes possible an uninterrupted stream of work easily and quickly handled between every operation in the Wood Working Shop

It's a simple system that can be suspended from roof trusses or ceiling beams—no changes necessary for installing.

Electric or hand propelled.

Special carriers will be designed to handle your particular products.

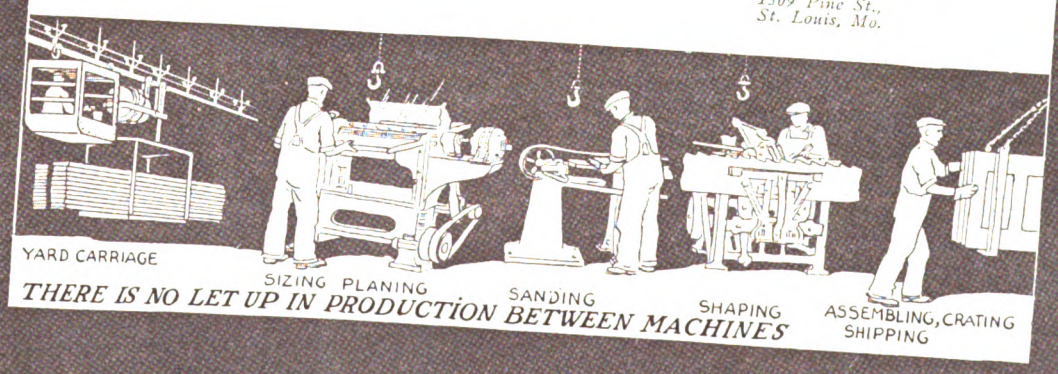
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inexpensive, easy to construct and easy to alter, reasonably fire resistent, and in the event of a fire the members are not likely to collapse until fairly well burned through. For industries using chemicals or materials creating acid fumes, wooden construction is often far more resistent to corrosion than metals or masonry.

The disadvantages of heavy mill buildings are these: They are more subject to vibration than other types; they are not permanent; they are not wholly fireproof; and they are subject to rapid deterioration if the processes they contain require or develop considerable humidity.

Concrete construction possesses the following advantages: It is rigid, permanent, strong, as nearly fireproof as anything that has yet been achieved, and relatively inexpensive to construct. Its disadvantages are the difficulty of altering the building, the fact that concrete floors are subject to dusting, and frequently require a surface of some other material, and that concrete (like other masonry) is subject to corrosion by chemical fumes of certain types. Most of these disadvantages are overcome if the structure is properly designed.

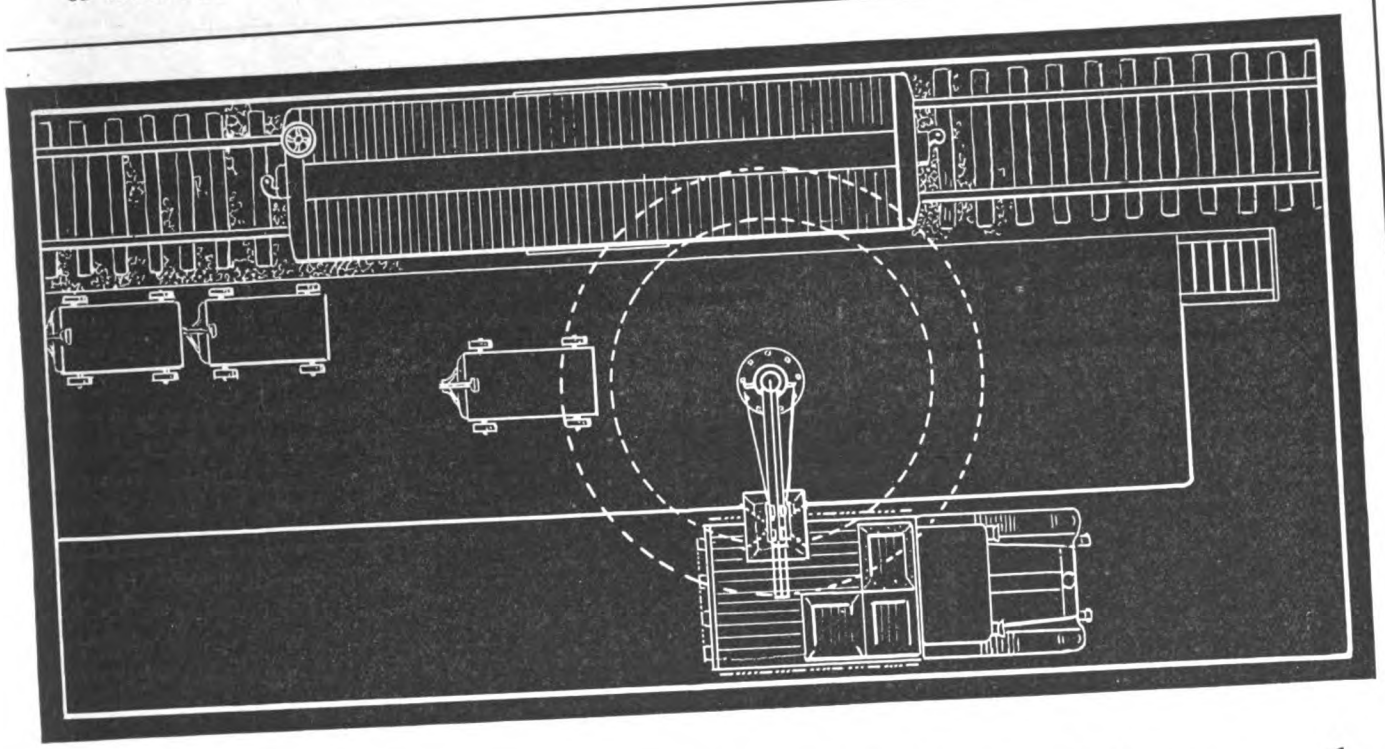
Unprotected steel construction is principally used in structures having unusual spans requiring trusses or other elaborate framework. Though usually considered fireproof, unprotected steel is a very hazardous material in the event of fire because if the columns or beams are heated by even a local blaze they are likely to collapse and distort or bring down with them a great portion of the structure not otherwise affected by the fire. Of course, steel is also subject to corrosion by acids or water unless properly protected.

Protected steel framework is lighter than concrete and is useful for tall buildings having relatively light floor loads. The masonry protection around steel columns practically prevents damage from fire. The choice between reinforced concrete and protected steel construction for buildings of normal floor loads depends a very great deal on the local cost of each type as their merits are otherwise almost identical.

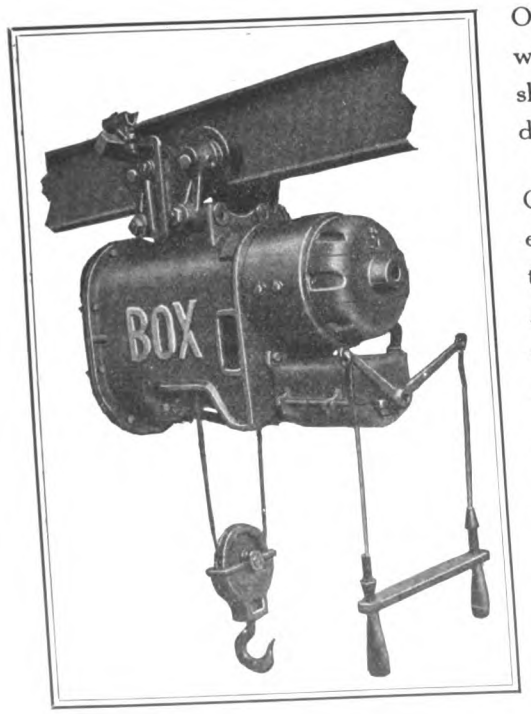
The final planning is almost a repetition of the process we have already outlined except that finer details are considered. The machinery templates are rearranged with precision on floor plans of fairly definite dimensions, and proper space is allowed for conveying equipment, work in process, and for the operatives. Columns are provided for in such a manner as to interfere least with the machines on all the floors, a process sometimes requiring a readjustment of the ideal arrangement here and there, for the columns must be directly in line, one above the other, except in very special cases. Likewise the stair towers, elevators, fire escapes, and the toilet and wash rooms are located in the positions which best meet the requirements of all floors taken together, for these items also need to be aligned vertically in most cases. It is often good practice to place all of these units in towers or small wings outside the main lines of the building to prevent their intrusion into an otherwise uniform floor arrangement. A clear open floor is a great aid to supervision.

Each item of equipment is next considered separately an

(Continued on page 76)



Everything Within Reach



One electric "Load Lifter" can be arranged, so placed that it will do a vast amount of quick, easy lifting. The illustration shows just one of many installations where the "Load Lifter" does a large amount of important work.

On a loading platform, from a self supporting jib crane, the electric "Load Lifter" handles merchandise from factory trucks to delivery trucks and railway cars. It is operated by one man. All lifting and shifting is done quickly, easily, most efficiently and at a very small power cost. The "Load Lifter" is on the job all the time—always ready for work.

The "Load Lifter" is BOX designed and made. Small, compact, powerful. It is in a lifting class all by itself. Absence of gears, cams and exposed parts instantly appeals to men who know machinery.

Let Box "Load Lifter" Engineers assist you to cut your lifting and shifting costs. Information and advice will be sent you by mail and is yours for the asking.

Alfred Box & Co., Inc., are also builders of the "Box Crane"—a standardized, heavy duty, Electric Traveling Crane in capacities of twenty tons and under; also builders of hand operated Traveling and Jib Cranes of any capacity. In addition, full line of Electric Hoists to five tons capacity—embodied in which are all the important features found in the "Load Lifter."

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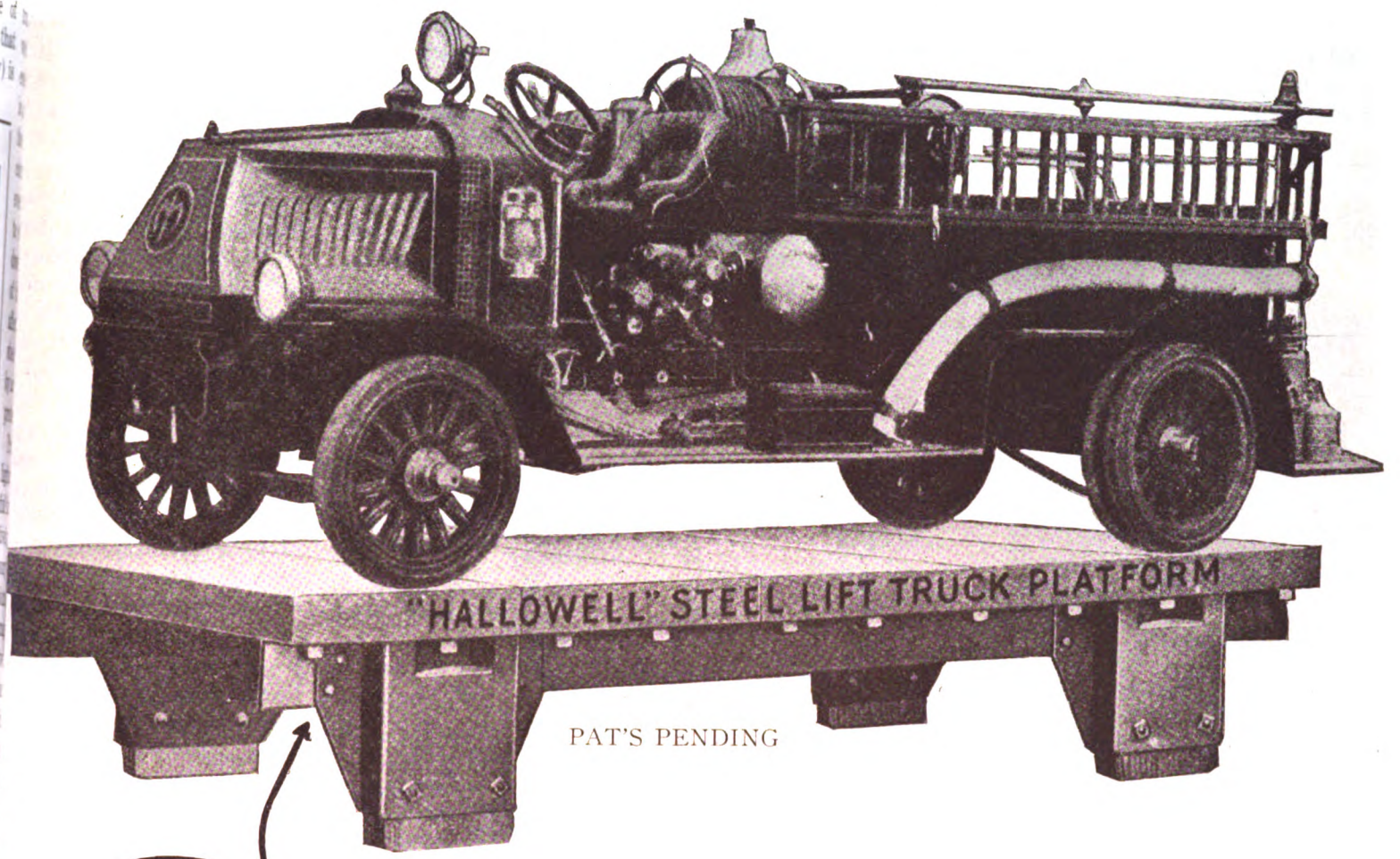
ALFRED BOX & COMPANY, INC. PHILA. PA.

BOX CRANES

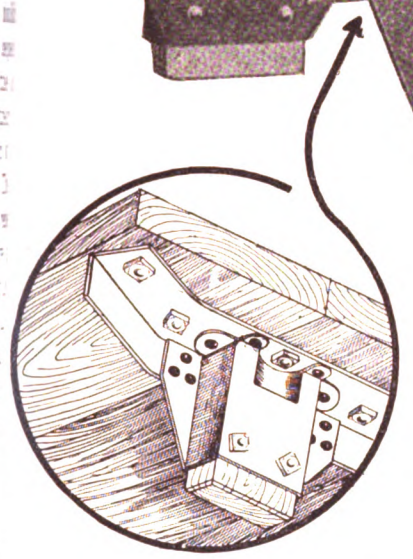
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The Platform that Carried 26,144 lbs.



PAT'S PENDING



Rivets—Hydraulically Driven —Not Bolted

"Hallowell" Steel Lift Truck Platforms are reinforced at every point where the stress and strain falls. For instance, instead of bolts, *Rivets —Hydraulically driven,* are used to fasten the steel leg supports to the runners. Bear this in mind when choosing lift truck platforms.

CAN you visualize 26,144 pounds of Babbitt Metal—13¾ tons—approximately the weight of the big Bull Dog Mack Truck shown above?

The "Hallowell" carrying a load of 4000 pounds was first tested by being pushed and dragged over a concrete floor with a Mack Truck. After standing up under this test successfully—quite a severe test—the load was increased to 26,144 pounds simply to determine whether or not any hidden weakness had developed. Every severe test was successfully met.

You will want to know the other reasons why the "Hallowell" construction means longer life to lift trucks. Write for details and prices.

STANDARD PRESSED STEEL CO.,
JENKINTOWN, PA.

(The "Pioneer" Steel Hanger People)

HALLOWELL

STEEL LIFT TRUCK PLATFORMS

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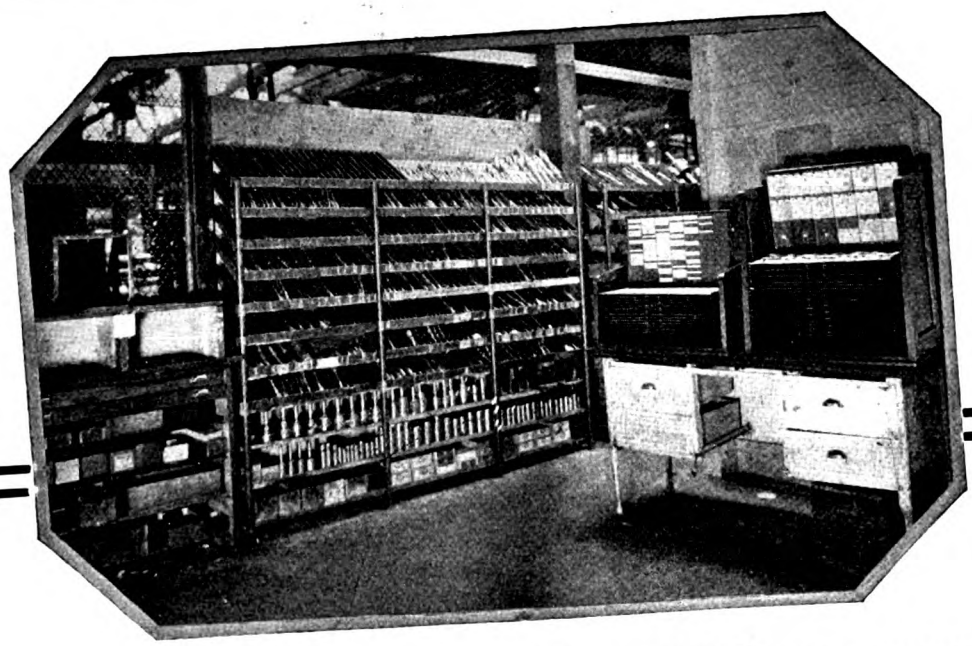
(*Continued from page 74*)

is designed to fit into the structure as now planned. In the electrical work the power requirement of each machine is determined and feeders are planned to distribute the power where needed. Control points are fixed, and if a power plant or sub-station is required, this is designed in detail. The location of switchboards, conduits, and distributing panels is marked on the plans, lest other equipment be placed in a way to interfere with their arrangement or utility. The lighting system is also planned, with illuminating units chosen and placed with reference to the needs of the machines and processes with which they are associated. The distribution of current to these units and to the switches controlling them is likewise designed and marked upon the plans.

The heating apparatus required for a building is an expensive and complicated item, as any owner will agree who has paid the bills. Yet too often the arrangement of the radiators, ducts, and the mains and return pipes is left to a heating contractor whose principal interest in the project lies in the profits he can draw out of his contract. Each part of the heating system must be planned with the same care that is given to the other parts of the structure, for pipes must not interfere with each other or with the machinery, electrical conduits, sprinkler lines and plumbing system. In the same manner each of these other items of equipment should be studied and adapted to the building in such a manner as to avoid conflict with each other and at the same time to cost as little as possible to install and operate.

The means of transporting material should be settled in detail, for the installation of the equipment will affect the structural design of the building. Monorails and trolleys or telephers require suspension from the ceilings, with space for switches and sometimes for transfer cranes. Electric hoists and travelling cranes require special supports from the floor or walls. Elevators of course have their shafts and pent houses, and require careful selection of their size, speed, and doors according to the work they are to do. If hand or electric trucks are used to move the material through the aisles, the elevator doors must have smooth sills, the aisles must have ample width and the corners at aisle intersections must be of such radius as to permit the trucks and trailers to negotiate the curves without striking. Belt, gravity, bucket, drag, and other kinds of conveyors likewise influence the structure for most of them require floor openings and special supports.

Upon occasion, this planning of equipment must go even further, to arrange for shafting, motor supports, process piping (such as process steam distribution) air washing and conditioning equipment, dust collectors, vacuum cleaning systems, and compressed air distribution. In a number of plants the writer has been concerned with it has been necessary to control the humidity of the air within one or two per cent., and to control the temperature within a degree. Sometimes the temperature must be high, oftentimes it must be very low. This means refrigeration machinery and piping, cork or other insulation on floors, walls, and ceilings,



In the Richards-Wilcox Plant, Aurora, Ill.

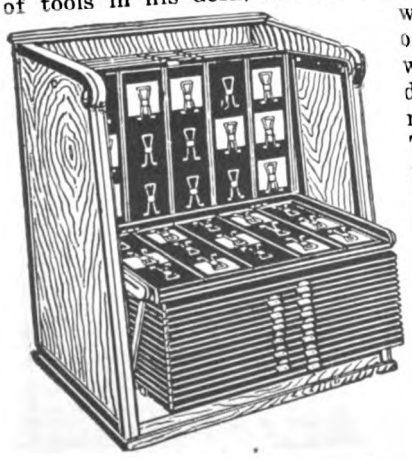
A 15% Cut in Tool Expense

Since They Installed a McCaskey

THAT'S what actually happened in the plant of the Richards-Wilcox Manufacturing Company at Aurora, Ill. But it's only one of the surprising benefits they derived from their McCaskey Register—benefits that may be yours as well. Read the others in the following letter of Mr. R. H. Bellmore, Assistant Superintendent and Production Manager:

"A reduction of over 15% in tool expense, the releasing of hundreds of dollars formerly tied up in over-stocked tools, the saving of many dollars lost in idle time and in holding up production while hunting for dies, jigs, etc., are some of the results we have accomplished in the past year with our McCaskey register.

"Now when a workman needs a new tool, a die, jig or sample he has just one place to go—our tool room. Before, each foreman kept a supply of tools in his desk, and no record was kept of who used them or when they were used. The dies and jigs had no definite place. To get anything from the tool room now, the workman must fill out a form in triplicate showing the tool, jig, die or sample drawn, the date, department and the signature of the workman. The original is filed in the McCaskey workman's register under the workman's number. A pink triplicate is filed in the McCaskey tool register under the number of the tool, and the yellow duplicate is given the workman.



Making the Workman Careful

"The workman has to account for everything charged against him in the register, and if tools are broken through his carelessness, or are lost, he has to pay for them. Naturally he is much more careful, and as a result we are buying over 15% less tools than formerly. We know too, just what tools we need and what we don't need. We used to order a large quantity of everything when we ran low. Now we order according to how fast we use the tools, and thus we are not tying up our money in slow moving stock.

"When a workman is through with a die now he brings it back to the tool room instead of throwing it down anywhere and forgetting it. We used to spend a day or two at a time looking for lost dies and jigs. That meant idle workman's time to say nothing of the loss due to held-up production. Everyone is enthusiastic about the savings we have effected through the installation of the McCaskey. And even the individual workman is more productive because McCaskey has made him more careful."

And in Your Plant—

You, too, no matter what your business may be can derive benefits of this character by installing a McCaskey System designed for your needs. It is no trouble to find out about them. Write us today.

THE McCASKEY REGISTER CO.

McCASKEY ONE WRITING SYSTEMS

Alliance — Ohio

Industrial Division
CANADIAN PLANT

GALT, ONTARIO

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double glazing in the windows, all of which is most economically installed if provided for in the original structure.

It is only at this stage that the structural plans are prepared in final form. We now know where every opening will come in floors and walls, where extra loads must be supported, and where economy of material will be possible because the loads will be permanently limited to an established maximum. The size of the columns is finally determined, the floor slabs or beams are designed, the structural or reinforcing steel is figured and the structural plans completed showing all of these elements in detail.

Now all of this detail is mentioned for a purpose. It is to bring about some realization of the importance of knowing what you want before you start planning, and of planning every detail with precision and thoroughness. Contractors are going to bid upon the plans and specifications of your building including every one of the items we have mentioned, and if your plans do not show exactly what you want your contractors will guess and gamble on what they think you want. And you may be dead sure they will gamble so as to win whichever way the bone rolls. Their estimates will include contingency items in proportion to the lack of precision and completeness of your plans.

Few people appreciate the fact that a manufacturing structure is a machine producing goods. It should be designed as machines are designed, to turn out a given product with the least consumption of power, effort, and material. Yet generally the building is considered apart from its product. If our mechanical engineers started designing machines just as pieces of machinery, without thought to what the machine would produce, how far would we progress industrially? Or if they first designed a machine and then converted it to produce a given article, how efficient would the resulting piece of equipment likely be? Yet we blithely plan our buildings first and then decide what to put in them!

Of course we do not wish to imply that all buildings are inefficient and poorly adapted to the process they contain. Fortunately, very many manufacturing processes require such light and easily arranged equipment as to fit into almost any building that has floors, walls, and a roof. Such equipment often can be effectively arranged in old buildings or in leased quarters. But when a company reaches the stage of success and output that it must have its own buildings it should plan its structures in the manner we have indicated, conceiving the building as a huge machine functioning with economy to turn out the desired product or group of products.

If this thought is clearly established in your minds you will give due consideration to the maintenance of this building which is really your largest machine. You will choose materials that will wear well, that will require little attention and replacement and you will thereafter inspect and groom your building as you do your most expensive piece of machinery.

We said at the start that the process of planning a manufacturing plant is a relatively simple process, and we still mean it in spite of the mass of detail we have touched upon. Except for the collection of data and the establishment of general policies, the work of planning the building and equipment goes forward rapidly and smoothly when in trained hands. Probably no plant owner or "layman" so to speak, could go through all of these steps without the guidance of experienced counsel. It is equally true that very few if any individual architect or engineer could handle with accuracy and assurance, all of the problems arising in such a program.

The planning of a factory requires the coördinated efforts of many trained experts. The owner and his staff supply one group of brains and experience. The architect and engineer, (who must be supported by a staff of structural, mechanical, electrical, plumbing, heating, and process engineers as well as by architectural designers) supply another group of brains and experience. Our industrial progress has carried us far beyond the one man shop, and so also it has brought about the need for the coördinated effort of many specialists in planning our factories and other machines. Pay for brains when planning and you will pay less for your structure and its finished product.



Handling Scrap with P & H 206 Corduroy Crane at Plant of American Manganese Steel Co., Chicago Heights, Ill.

American Manganese Steel Company Chose The P & H Corduroy Crane Because They Wanted

Crane Service Everywhere without track or runway expense.

A Crane to Operate at Either Side of a Railway Car and reach any car without costly delays when spur tracks are filled.

A Crane That Starts and Stops Instantly, operated by gasoline or electric motor, and requires no fuel or water hauling expense.

A Crane That Creates No Smoke Nuisance and therefore can be used inside of buildings also.

A Crane With Wide Range of Application that can be used with hook, dragline or clamshell bucket, etc.

A One-Man Operated Crane that requires no night watchman or fireman.

The P & H Corduroy Crane Has a Pedigree

The Corduroy Crane has all of the characteristics mentioned but it has something more. It has back of it the experience and reputation of a firm which, in its 39 years of existence, has built more than 7000 different types of cranes known for excellence all over the world. The ***Corduroy Crane*** must and does sustain this reputation.

Among the prominent industrial companies, railroads, steel plants, lumber mills using P & H Corduroy Cranes for handling pig iron, scrap, castings—coal ashes, gravel, sand, are:—

Aluminum Co. of America, New Kensington, Pa.
American Brass Co., Buffalo, N. Y.
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The Bettendorf Co., Bettendorf, Iowa.
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The Ingalls Iron Works Co., Birmingham, Ala.
Malden & Melrose Gas Lt. Co., Malden, Mass.
Mohawk Valley Cotton Mills, Utica, N. Y.
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In making your future plans investigate the possibilities of a ***Corduroy Crane*** in your plant. Bulletin 40-X gives the details, copy will be mailed on request.

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P&H CORDUROY CRANES

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The British Coal Plan

By Thomas Meloy

THE troubles of the British coal industry have been similar to those in America until the smash-up of 1921. After it, the industry reorganized upon the largest scale profit sharing plan in the history of labor relations, and, notwithstanding several bad starts and much gloomy prognostication, the plan worked. At a recent meeting of the British Miners' Federation the miners resolved to continue the present agreement and the mine owners have recently expressed themselves as satisfied to go ahead. Neither party is satisfied, but both believe it the only possible arrangement. Two years ago nationalization of the mines appeared probable. It is now only a possibility.

In part the agreement was revolutionary, since it called for profit sharing, and this in an industry of all others the most complicated from a profit sharing point of view, and it also called for profit sharing on a scale never before attempted in any industry. It marked for British industry as a whole a radical departure in the determination of wages, for henceforth the base was to be not prices, not the cost of living, but profits. In spite of the haste with which the agreement was written, within one year of operation the following results were achieved:

1. The rate of wages was cut in two.
2. The labor cost per ton was cut almost to one-third.
3. Production was substantially increased.
4. Unemployment in the industry was reduced to a minimum.
5. The coal business was revived, and in spite of the depression attending the continental chaos, the present year is likely to reach or surpass the volume of the best year the industry ever had.
6. Coal has been produced at a profit in the majority of the coal fields.
7. Owners and miners have shared this profit.
8. Since 1921 there have been practically no strikes of any kind.

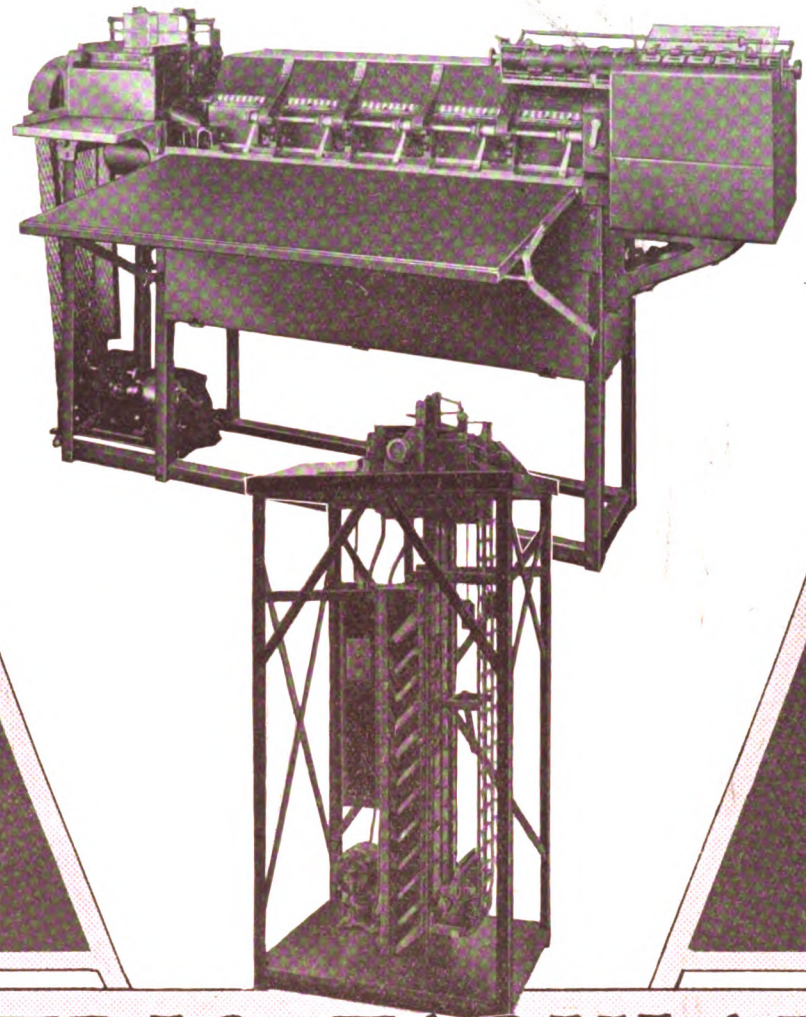
This is a record unparalleled in the history of twentieth century labor relations, especially in a period of constant labor unrest and a constant demand for higher wages, regardless of economics. Profit sharing, in theory at least, is usually considered to be the most sound basis upon which to build labor relations, but hitherto profit sharing has never succeeded on a large scale, and where it has succeeded the results have been due rather to the sincerity a

(Continued on page 80)



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ACCURATE ANALYSIS—*PROMPTLY!*



ELECTRIC TABULATING *and* ACCOUNTING MACHINES

ECTRIC Tabulating and Accounting Machines provide a means whereby ate reports on costs, sales, ction, payroll, plant in- y, voucher and purchase bution are obtainable in detail and with greater than by any other method.

ctric Tabulating and Ac- ing Machines are manu- ed in various models. list in detail, print totals, ey compile results in non- ed form. There is a model made especially to meet the requirements of every business and industry.

The use of these machines enables permanent records to be made and filed in card form instantly adaptable for current use or for future requirements when needed. Let us tell you how these machines will bring new efficiency to your accounting routines, and the other phases of your statistical work which call for speed, accuracy and completeness.

The upper illustration shows one model of the Electric Tabulating and Accounting Machine supplied to meet the requirements of every business. It adds from 150 to 750 separate items per minute, printing the individual amounts or the amounts accumulated as desired.

The lower illustration shows the Electric Card Sorting Machine which sorts and groups records into any desired class or predetermined sequence at the rate of 250 cards per minute.

THE TABULATING MACHINE COMPANY

Subsidiary of COMPUTING-TABULATING-RECORDING CO.

50 Broad Street, New York

Offices in all principal cities of the United States and Canada
Members of the National Association of Office Appliance Manufacturers

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(*Continued from page 78*)

ability of a particular executive than to the plan itself. In fact, profit sharing plans have so often failed in their purpose that the principle itself has been falling into disrepute and receives scant consideration as far as the practical leaders of labor and capital are concerned.

The success of the British plan is probably due to its simplicity, notwithstanding an apparent vast complication of details. The latter, in keeping with many other British institutions, including the monetary system, is largely the result of various traditions, historical and otherwise. These details are not essential to the plan, which works in spite of them. The essential features are about as follows:

1. Great Britain is divided into its major coal districts which number, for purposes of the plan, 13.
2. A basic wage rate is agreed upon for all of Great Britain, and this rate adjusted for all forms of labor government in each district, very much as the basic rate of the American Central Competitive Field has been so adjusted for other fields and for the different forms of labor. This standard rate as finally agreed upon represented a wage cut of more than one-half.
3. An independent firm of chartered accountants examines the books of all the collieries of each district each month and determines thereby the gross receipts and the total cost, and thereby the theoretical net profits.
4. The mine owners are allowed to take 17 per cent. of the amount of the total standard wages as a standard profit.
5. If there remains any profit when this standard profit has been deducted from the net, it is divided between the company and the men, 83 per cent. going to the men, and 17 per cent. going to the company.

This ratio of 83-17, as well as the standard profit, 17 per cent. of standard wages, was determined after much statistical research. It was originally planned to compute the total capital invested in the coal properties, and thereby to devise a return on such capital which would be fair, and which would be enough to attract more capital. In other words, a minimum capital living wage. In practice, however, it was found impossible to reach an accurate estimate of the capital invested and the ratio of profits to wages was studied over a period of 20 or more years. The results show that profits have averaged about 17 per cent. of wages.

Two more provisions were tacked on to the agreement at the last moment, which later almost wrecked it:

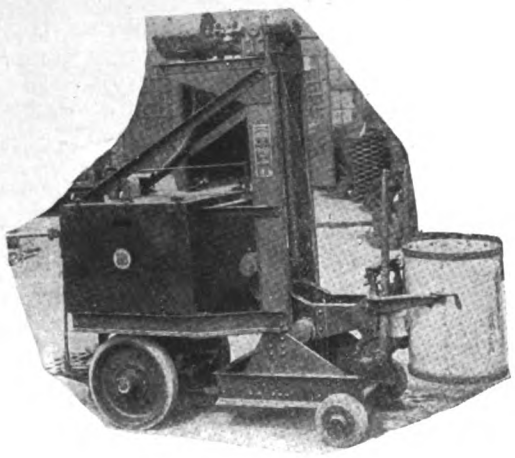
(a) That where profits were not sufficient to pay the owners their 17 per cent. standard profit, the deficiency should be carried forward as a first charge against future surplus.

(b) The cut in wages, as represented by the standard rates agreed upon, was considered too drastic, in view of the present living cost. Therefore, it was provided that even if the profits did not so warrant it, the men should receive a mini-

(*Continued on page 83*)

One of Them Will Fit *Your* Needs





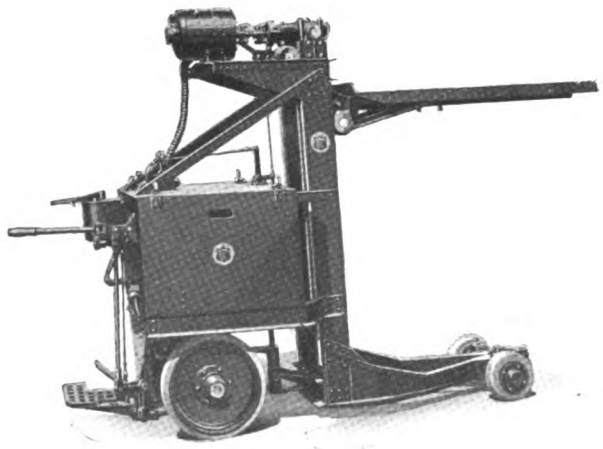
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Lakewood engineers, however, have met and overcome so many differing lifting and carrying questions in so many industries, that the chances are one of the present types will be just what you need.

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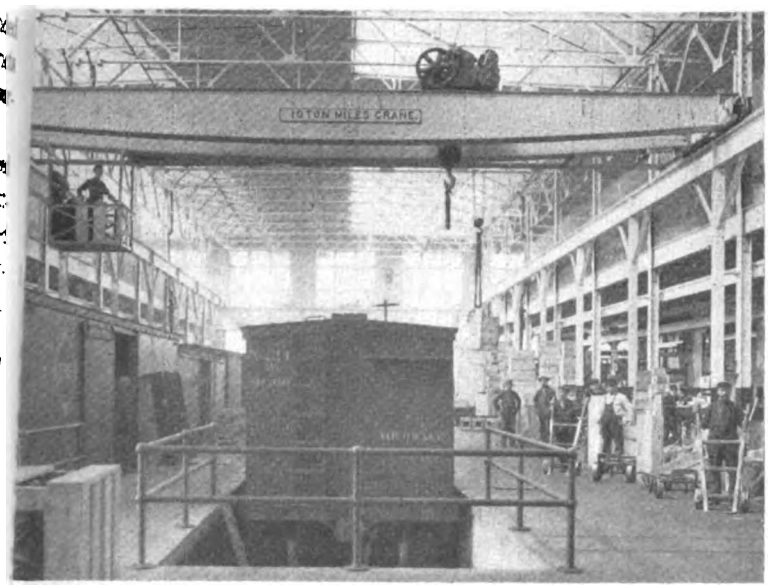


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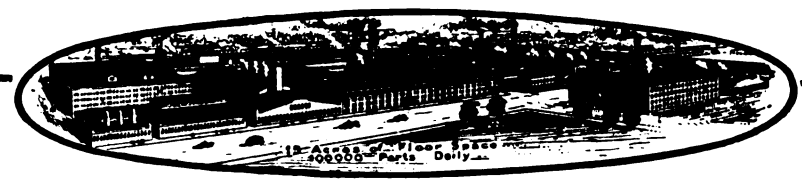
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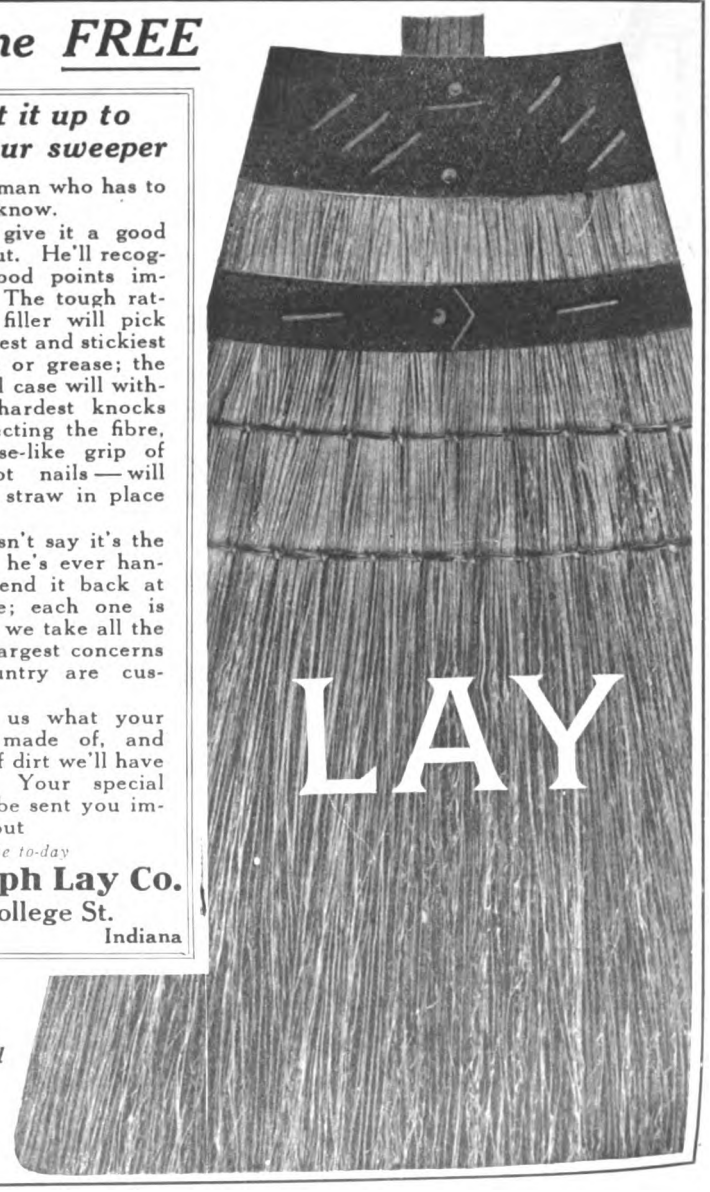
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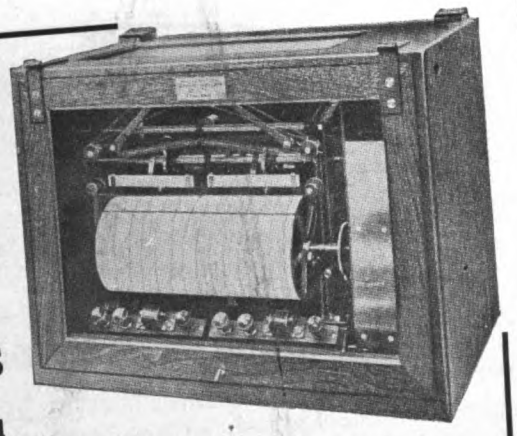
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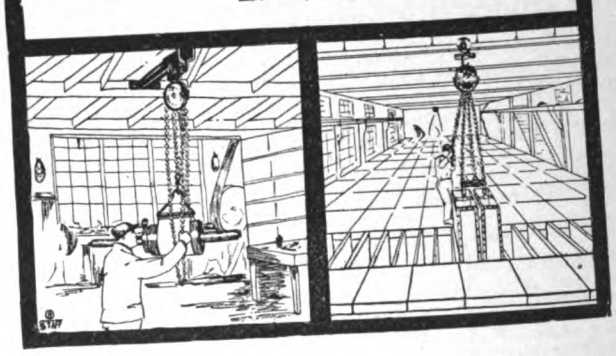
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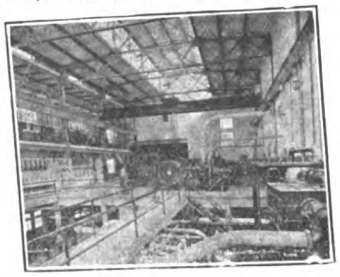


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(*Continued from page* 80)

mum of standard wages, plus 20 per cent.

By a peculiarity of the wording, Clause (a) was found only to apply to loss of standard profits, and not to losses occasioned by the 20 per cent. minimum. As a result, both (a) and (b) have been continually a source of dispute. The trouble could have been avoided in the first place by making standard wages 20 per cent. higher, and possibly decreasing the 17 per cent. standard profit. The present arrangement does, however, have the effect of favoring the owners when times are good, and of favoring the men when times are poor.

There is a fundamental difference between the British plan and the general run of profit sharing schemes. Profits are not distributed directly in the form of a bonus, but indirectly in an increased wage rate. Thus, wage rates are constantly subject to profits, and are based upon them. In the beginning, for example, the independent accountants studied the returns for each month separately. During February they would study the January aggregate district income, and expenditures, and thereby determine the theoretical profits for January. The results would be published sometime before March 1st and determined the wage rates for March. Thus, if January had been a good month, and there was a large surplus, the wages for March might be standard, plus 40 or 50 per cent. If February was a poor month, the wages for April would decline. These wage rates are computed separately for each district. The fees of the independent accountants are shared equally by the mine owners and the miners. As time went on, however, the miners found the monthly accounting charges rather high; also the time limited for study. Therefore, at their request the period for the checking of the aggregate districts disbursements, receipts and profits was increased from one to two months, thereby cutting the accounting work in two. Thus, January and February are taken as a whole, and the results (worked out in March and April) are the basis of the wage rates for May and June, while March and April determine the wage rates for July and August, etc.

The new agreement has had one notable effect upon the men. It has educated them to the financial problem of coal mining. The publication of the figures prepared by the independent accountants has revealed the fact that profits are surprisingly low. The men have also discovered that directors' fees and salaries lumped together amount only to a small fraction of the total charges, and if entirely abolished, would not perceptibly affect their wages. They have also come to an appreciation of the uncertainties of profits and the narrow margin between profit and loss. Some of them have lost their enthusiasm for Government ownership, as they see that even if all the profits were paid in wages, a slight increase in efficiency of management upon the part of the Government could readily wipe out all the advantage.

The disposition of the men is to call for more details. They want to know where supplies are purchased, and to be assured that there is no waste. At first, this increasing inquisitiveness may seem to the mine owner



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Modern methods require greater production at lower costs. Even in the boiler room is this evident. Every pound of coal must produce the maximum output of steam. This has resulted in higher capacity boilers and greater steam pressures and temperatures.

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dangerous, but it is a healthy tendency. The men are interested in economizing supplies where possible, and suggest means of saving. Several mine owners' associations have capitalized this spirit, and distribute placards stating, for example, that 83 per cent. of every mine prop saved belongs to the men, etc.

The British miners' union is now dealing with clean-cut economic facts. They see that even if they obtained all the profits, there would be only a small increase in wages. They seek to increase profits. They propose to increase operating efficiency; also to improve methods of coal distribution. As a large part of British coal is sold for export, the miners are interested in export prices and realize that they cannot increase labor cost and therefore coal prices, without losing their foreign markets.

There are two features of the British agreement that are in marked contrast to American practices.

First is a provision for the arbitration of all disputes. Under the present contract there can be no strikes. Every dispute must eventually be referred either to a district or to a national board of arbitration with an independent chairman. This marks a decided advance. For several years the American operators have asked the union mine workers to agree to arbitration as a final means for settling disputes, but thus far it has never been agreed upon. The United Mine Workers take the stand that they will not submit disputes to an arbitration board, and that they will not recognize the right of any neutral or impartial judge to enforce a decision.

Second, there is no check-off. Its nearest approach has been a demand upon the part of certain union officials that the operators employ no miner unless the latter shows a card with paid-up dues; in other words, the button system. This was rejected upon the basis that it was none of the operators' business to interfere in union affairs, and this has been acknowledged by the men.

No strikes, no violence, cheap and plentiful coal, speak well for the profit sharing agreement. In contrast, the British railway workers have a sliding scale of wages based upon the index of the cost of living. Under it the efficiency of labor has not increased. It has been the source of much dispute, and the decline in the index figure of the cost of living with the corresponding decline in wages, threatens to disrupt the entire agreement.

Aside from the possible application of the British plan to some part of our own coal industry, it might conceivably be extended to other industries. Notably, the railroad brotherhoods are constantly demanding increased wages in proportion to the increased efficiency of railroad labor. In the end they hope to secure for their members a participation in the earnings of the railroads. Labor as a whole is constantly demanding more and getting more. It would seem part of prudence as well as wisdom to give it a share in the profits rather than continually to grant wage increases, regardless of the value of what the labor has produced.



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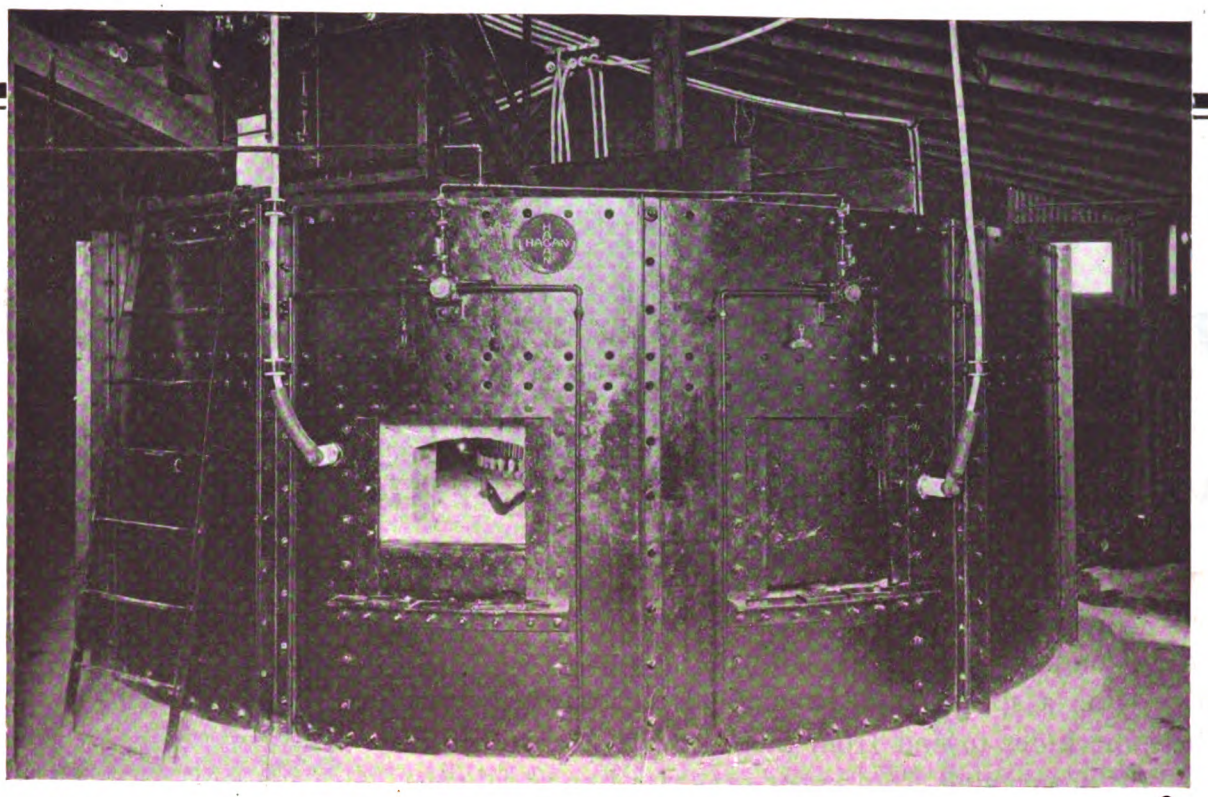
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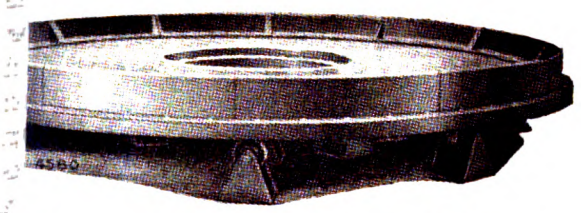


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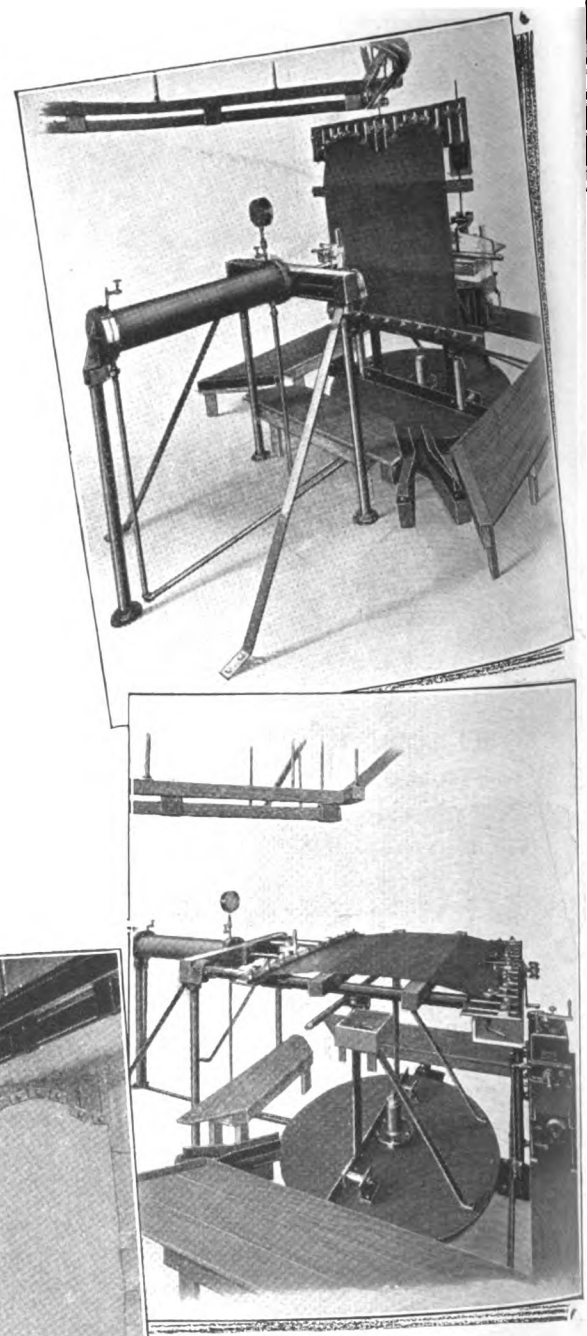
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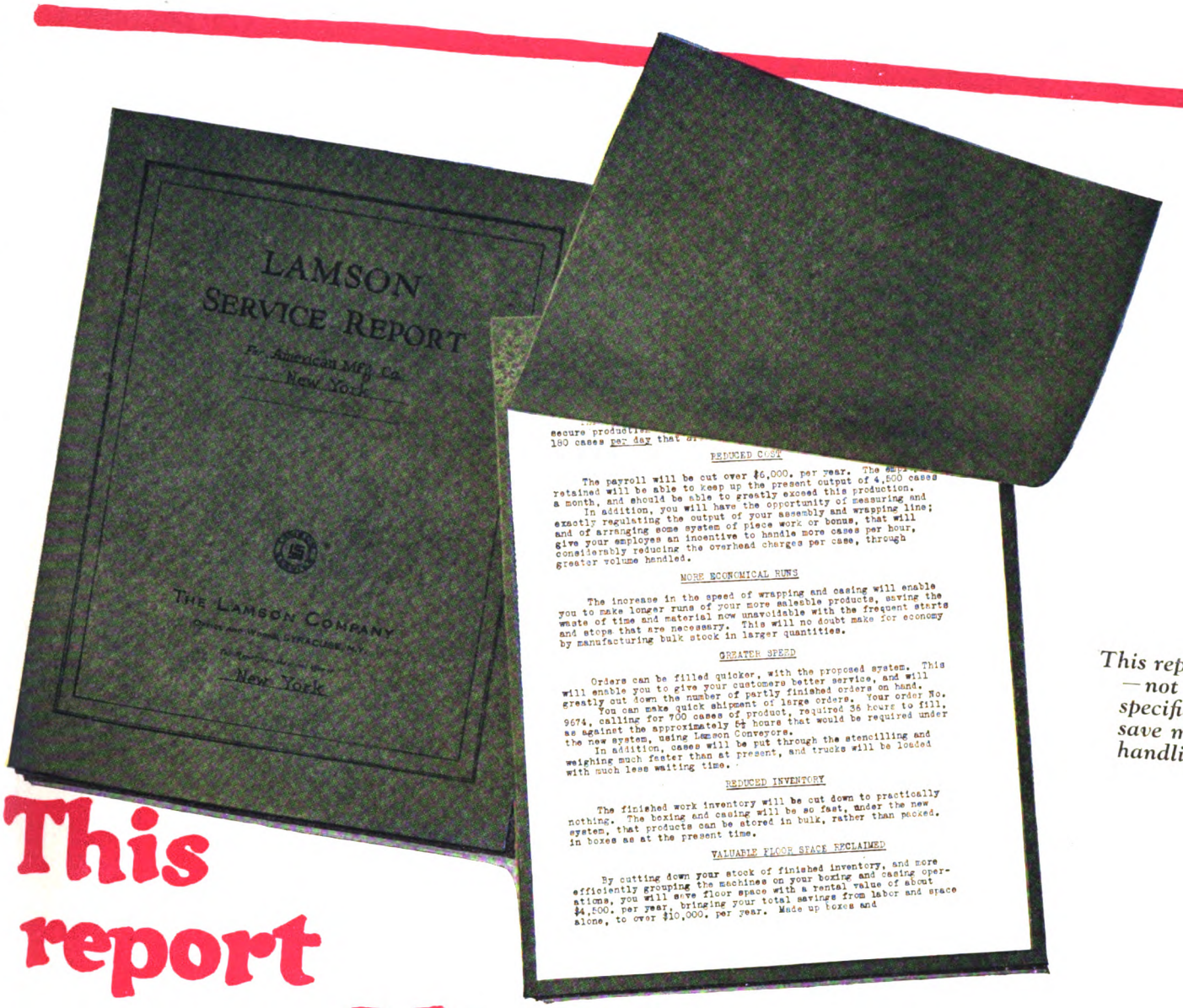
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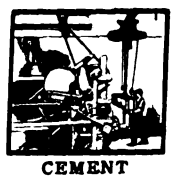

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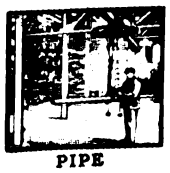

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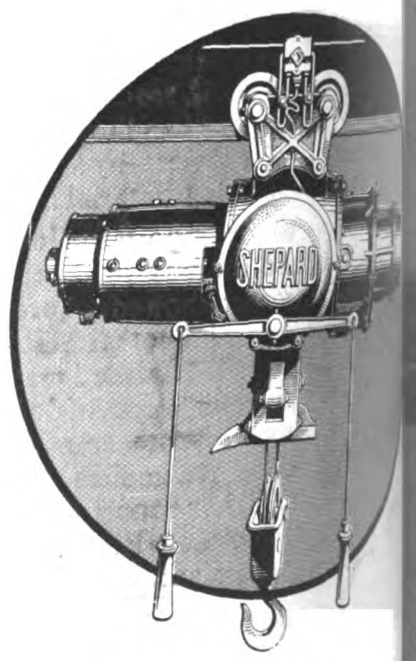
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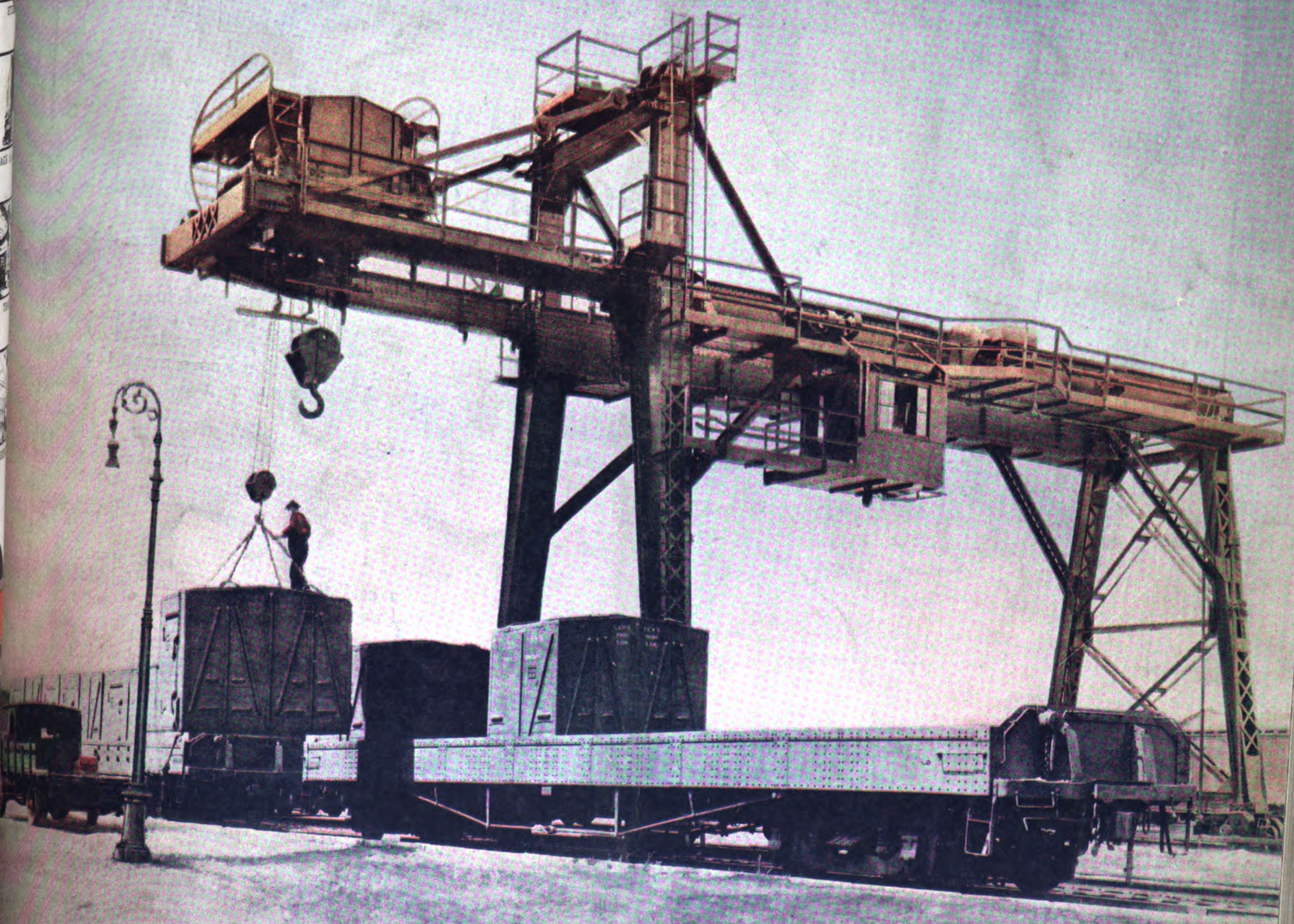
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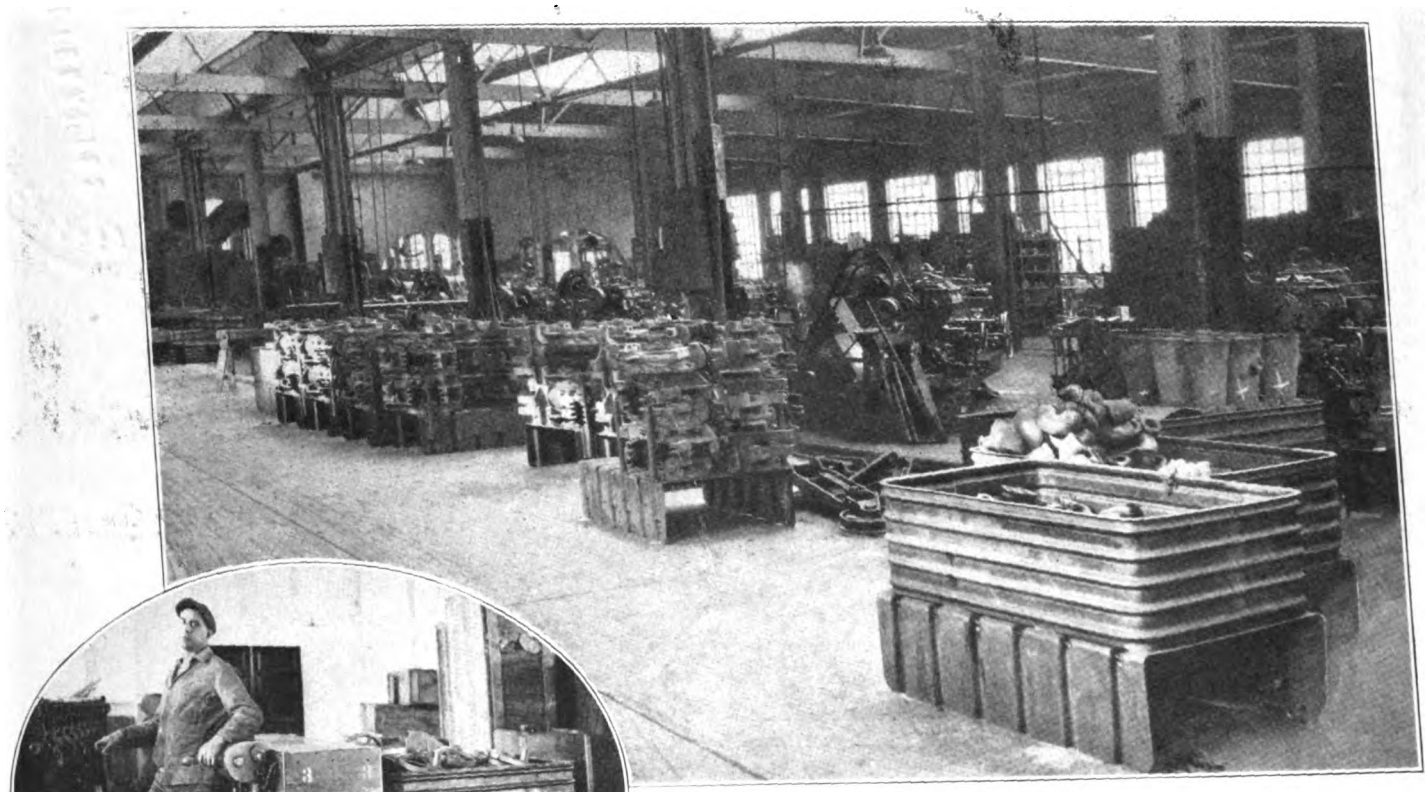
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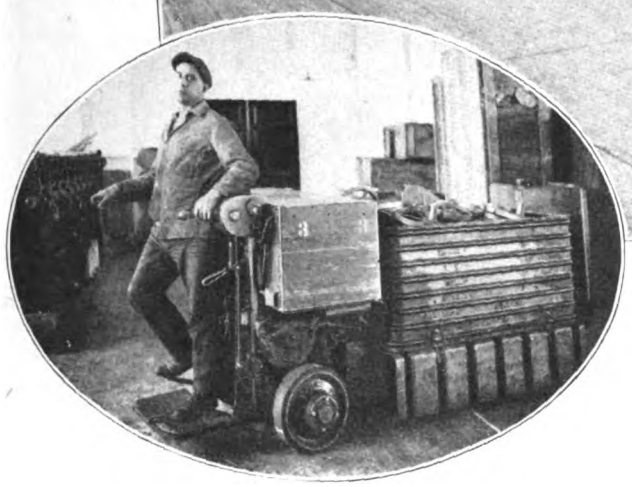


In This Issue

Helping to Solve the Nation's Transportation Problem

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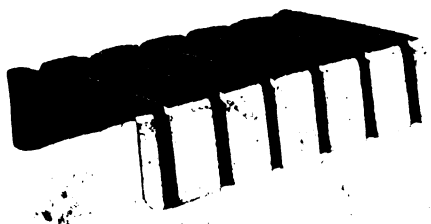
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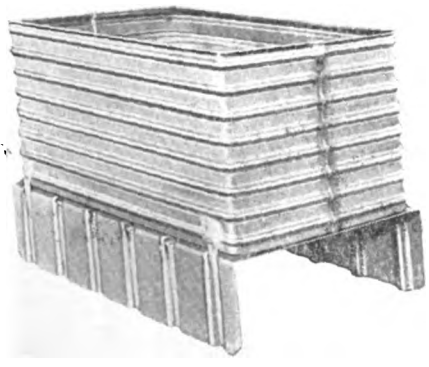
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Two wheel trucks, four wheel trucks, trailers, lift trucks—all become Better Trucks when equipped with Hyatt roller bearings.

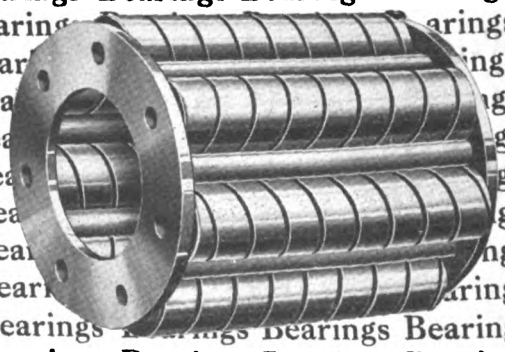
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1—After incurring a $500 demurrage in one month, the Capstan Glass Company ordered this Barber-Greene Conveyor. It completely eliminated demurrage at this plant.



2—For five years this Barber-Greene Conveyor has been used for unloading sand and lime, for moving them to bins, and for handling wet ashes.

3—Replacing a steam shovel with a Barber-Greene Bucket Loader, for loading coal and cinders at the Pennsylvania Edison Company. It loaded 109 tons in 4 hours, with only two trucks running over a 2 mile haul.



4—This Barber-Greene Conveyor at the Oxweld Acetylene Plant stores six carloads of coal where hand labor could store only one.

5—Reclaiming coal from storage piles at a large plant. The Barber-Greene Bucket Loader discharges onto a Barber-Greene Conveyor, which carries the coal to a permanent conveyor system.





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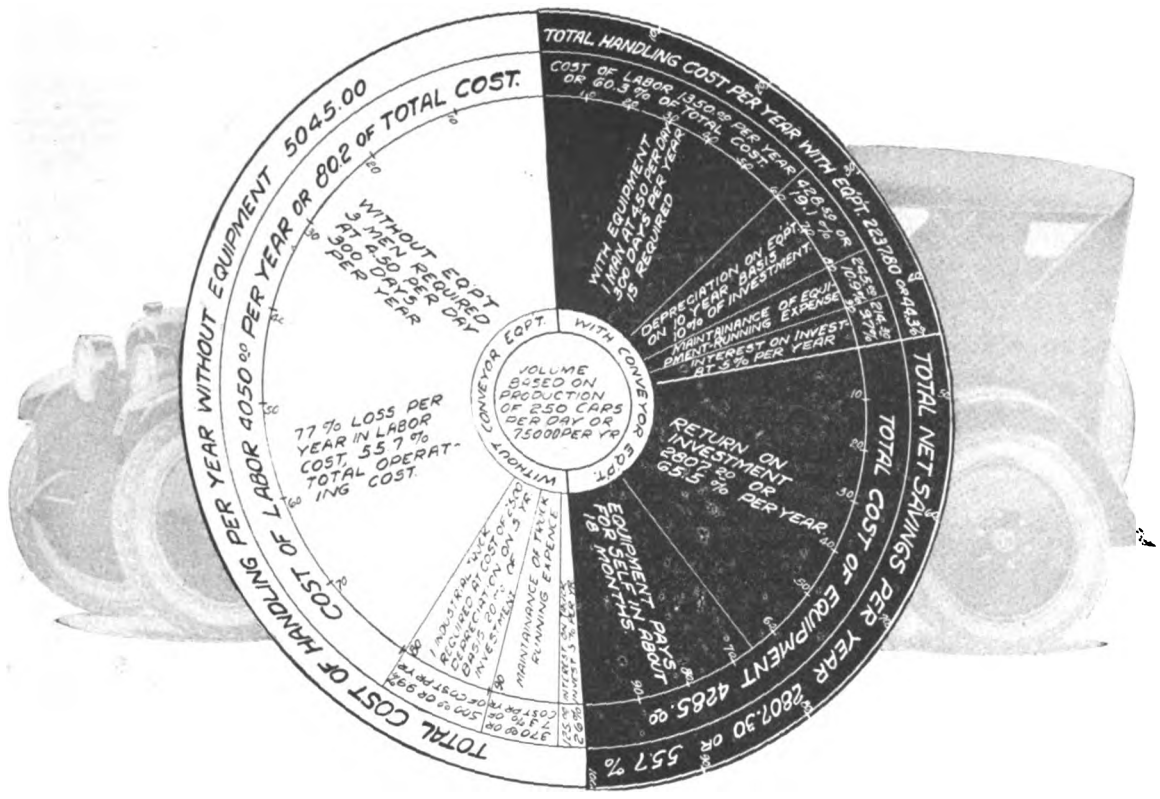
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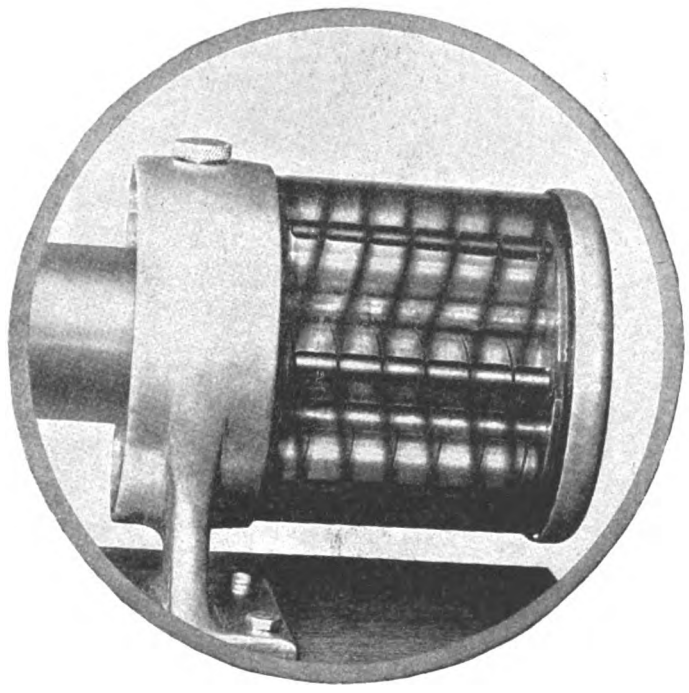
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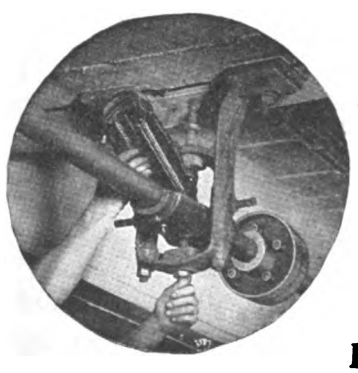
As the hollow rollers revolve, the oil flows out of the slots in parallel bands which cover the entire bearing surfaces. As long as any oil remains in the bearing it will be constantly picked up by the rollers and distributed in the path of the following rollers.

Because of this positive, self-oiling feature of Hyatt roller bearings it is only necessary to add lubricant to them occasionally, usually 3 or 4 times a year, which makes a worthwhile reduction in lubrication costs, oil and labor.

This positive, self-oiling feature of Hyatt roller bearings is only one of their good points.

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Split throughout, Hyatt roller bearings can be applied to existing lineshafts without taking down shafting or removing pulleys, collars or couplings.

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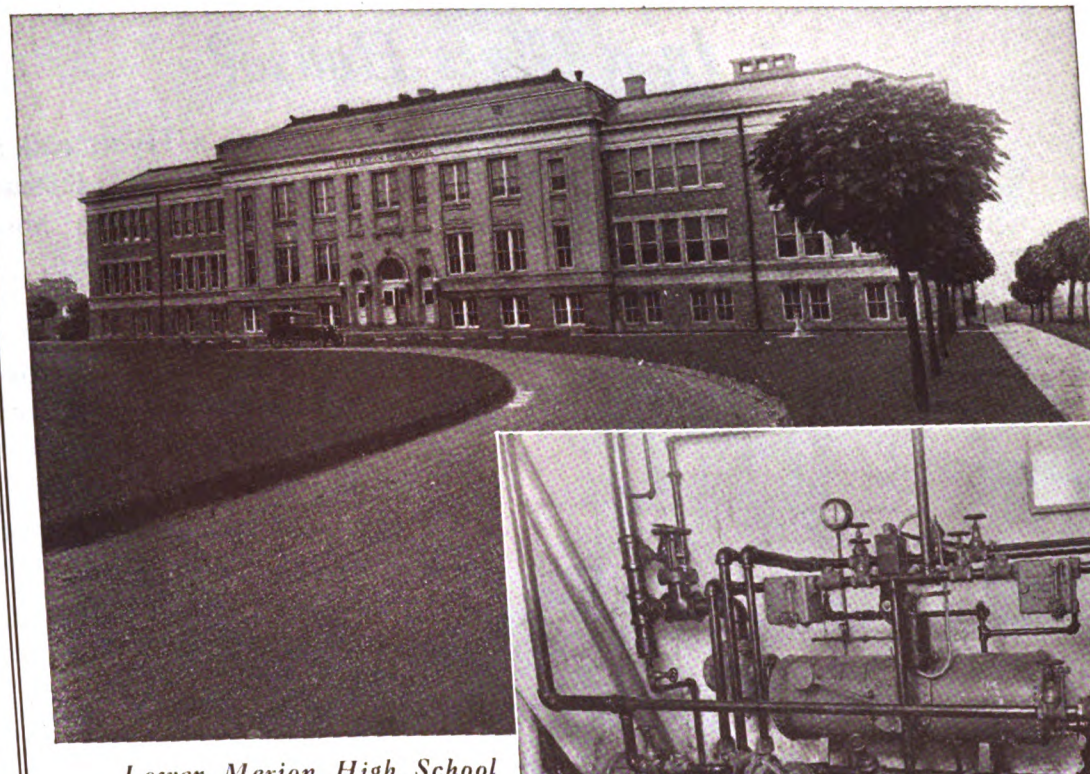
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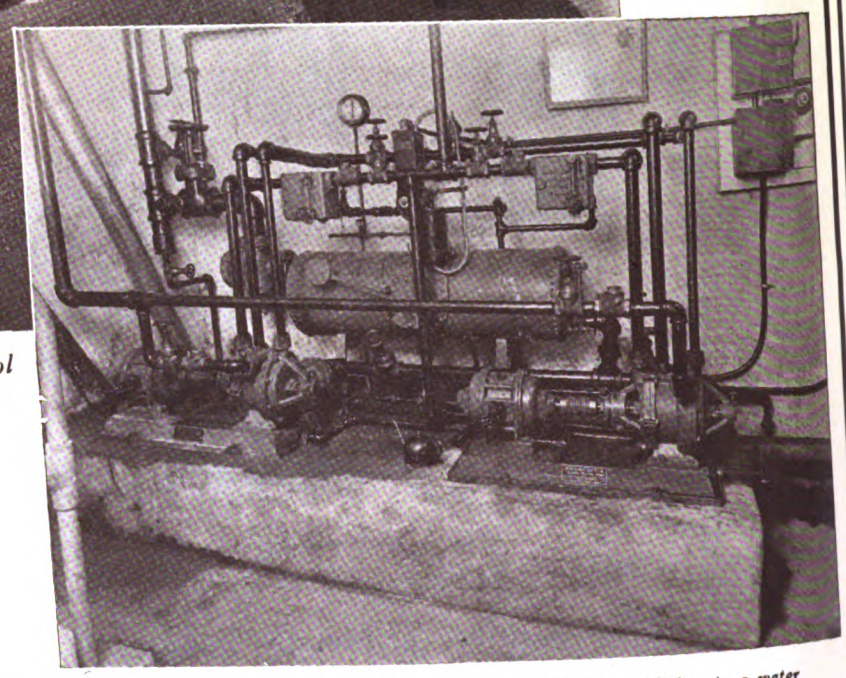
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Industry Illustrated

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EDITORIAL

Real Executiveship

IF the whole world were governed on the same basis of efficiency as you govern yourself, would it be as dependable as it is now? To be a foreman, chief clerk, superintendent, manager or president or to hold an executive position of any kind, requires of that person demonstrated ability to govern himself. The man who cannot control his own emotions or thoughts is in no position to correct the inharmonious thoughts of the other fellows. To be boss in any organization carries with it the privilege of being an example and a guiding hand to those it is your privilege to direct.

The head of a department or the executive in charge of any business cannot create a single idea to put into that business. All that ever was or ever will be created is all ready. Therefore, his position corresponds to that of a leader of an orchestra. The leader does not put any music in that orchestra, but through his understanding of the laws of harmony he is able to eliminate the discord, leaving only the perfect harmony. His ability to produce good music is measured by his understanding of the principle of harmony.

So the man who is the directing head of any business must be able to eliminate the discordant thoughts in his own consciousness before he can do this in his organization. If he allows such discordant thoughts as envy, jealousy and selfishness to express themselves, he need not be surprised to find these same thoughts reflecting through his organization. On the other hand, if he insists that within himself he will be fair and square, honest and just, which are the elements of true harmony, he will find this true harmony reflecting to all those who are his co-workers.

The man who guides the operation of other people in their daily lives and work must accept the responsibility of maintaining a high standard of thought for himself, thereby helping those with whom he works to appreciate and enjoy the advantages of perfect harmonious conditions. To the extent that an individual is able to control his own thoughts and actions, to that extent will he be successful in controlling and directing the thoughts of others.

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Carpentry, Masonry, and Plant Maintenance

By William G. Ziegler

A LARGE proportion of the maintenance work done by the carpenters and masons is the upkeep of the buildings and their permanent equipment. This work is very important and must be well done if the plant is to be kept in good condition and remain at nearly the same value year after year. If it is allowed to run down even to the extent of having worn out floors, this neglect will directly affect, and increase, the cost of trucking and indirectly will reflect in the morale of the men. We all know that as soon as any material becomes badly worn the rate of depreciation increases, and buildings are no exception to this rule.

Wooden factory flooring is usually of a cheaper grade than that used in offices or homes, as it is not so important to have the highest grade of lumber as to have good wearing qualities. It is usually considered that oak and maple are harder than most of the other woods and therefore are very good for resistance to wear. However, hard pine has been used for factory floors for many years and has given fine service. Many woods are now being used for flooring that will make a determined bid for favor among engineers; among these being the cypress from the south and the big firs from the west coast. Most flooring is tongued and grooved to hold it solidly together, but in some plants straight sided flooring is used as it is easier to replace. When a whole floor is badly worn the top flooring should be ripped up and all nails pulled out before starting work on the new floor. Sometimes only the trucking aisle is badly worn and in this case it may be found advisable to simply lay a new floor in that portion. If the old floor is laid parallel with the aisle it is easy to rip up but if it was laid crosswise each board has to be chiseled square at the edge of the aisle. In this case the new floor is often laid right over the old one by slipping thin strips of wood called shims under the new floor as it is laid in order to make it solid.

Wood blocks are often laid, in maintenance work, directly over a worn floor of concrete or wood. In this case the surface must be levelled up before laying the new blocks. The creosoted or treated blocks have been used with good

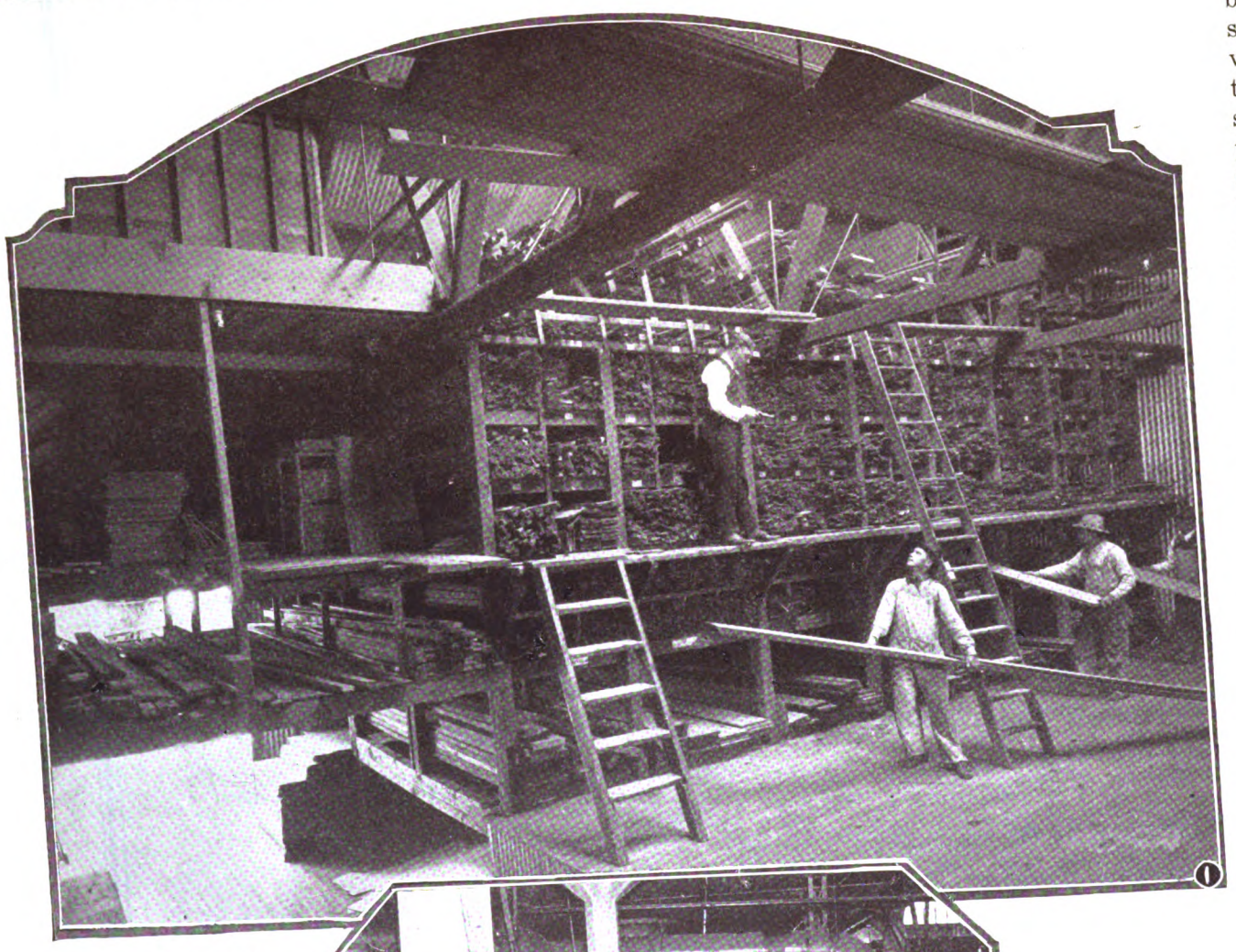


Fig. 1. Where there is much work for the carpenter in connection with maintenance and alterations, it pays to buy and stock larger quantities of the most-used sizes of lumber.



Fig. 2. Installing built-up wood block flooring over worn concrete, without interruption to production, in a plant of the American Can Company.

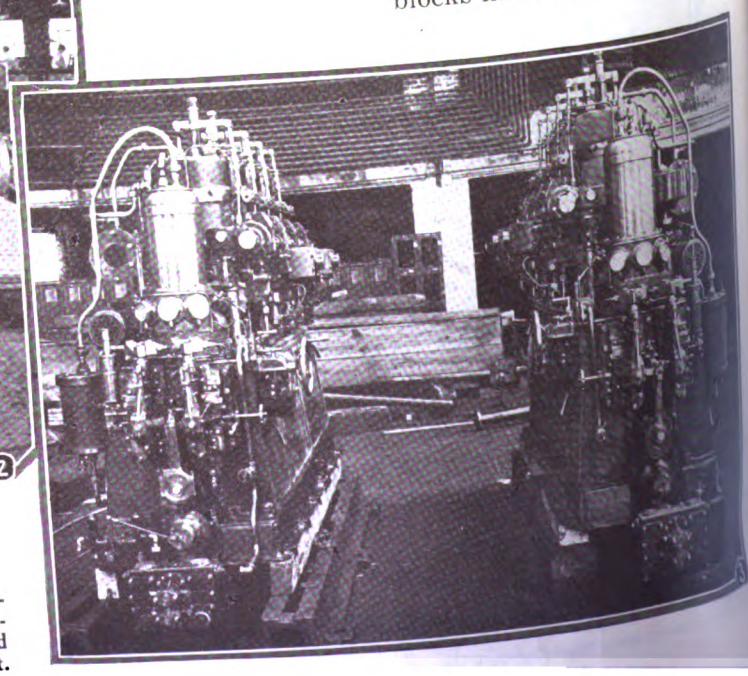


Fig. 3. The wood block floor is particularly suitable where heavy parts are handled. Note here, also, the single-tier and double-tier lockers discussed in the text.

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Fig. 4. The good old stand-by, tongue-and-groove flooring of maple or hard pine, and latterly of cypress and western fir, has by no means been relegated to obscurity.



Fig. 5. For large doorways, the rolling steel door is admirable because of the small space it requires.



Fig. 6. Where constant trucking through doorways is necessary, provision should be made for opening the doors without requiring the truck operator to leave his seat.

success in maintenance work of this kind where the floor is subjected to heavy trucking or severe wear. One type of blocks are dovetailed to an under strip and these sections or lengths of blocks are grooved for splines that hold the sections or lengths together just like tongued and grooved flooring. One of the newer types of block flooring is a redwood block flooring from the western coast. These blocks are not treated and may therefore be used in some special places where treated block floors would not be suitable.

There are often places where machine operators complain about having to stand all day on concrete floors, especially in basements where they are apt to be cold or damp. It is often advisable to build small gratings of strips of wood for the operator to stand on. These should be made so they can be easily moved by the sweepers. When the surface of wooden floors is uneven, and this is frequently the case with newly laid floors, a rotary floor scrubbing machine can usually be equipped with a sanding disc to take care of this work.

Good floors help to speed up production because they make the trucking of materials from one department to another faster and safer. In some plants with uneven floors, machined parts are often jarred off the trucks and the loss due to this item is often very large. It is also evident that if floors are kept in good condition the amount of repairs on trucks will be lowered.

In shifting departments around or when new or heavier machinery is installed in old mill construction buildings, it frequently becomes necessary to reinforce the floors to carry the additional loading. If the heavy loads are imposed on the first

Fig. 7. It is surprising how much money can be saved in both lumber and labor through an intelligent study of crating.



Fig. 8. Box shook machine, which takes rough lumber, from 3″ to 7″, planes it both sides, dovetails, glues the widths into solid sheets, and cross-cuts to length desired, also ripping this shook to finished width.

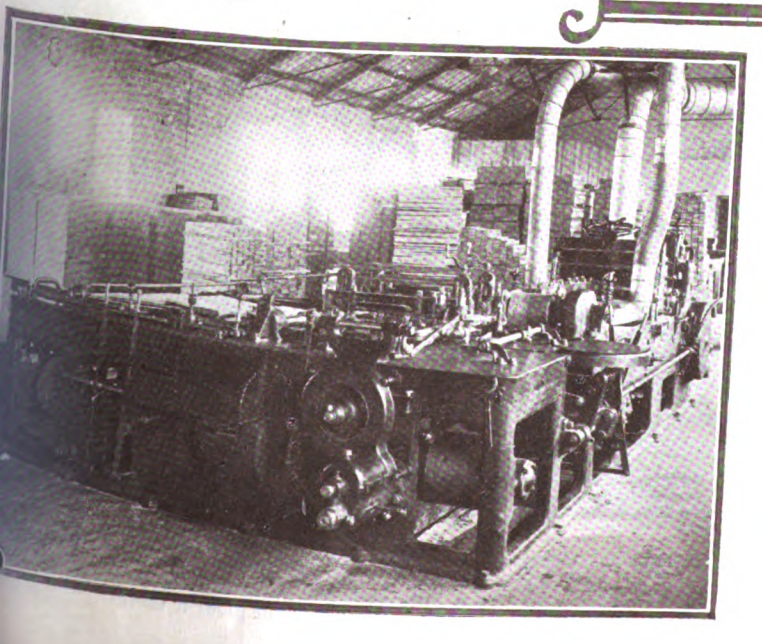


Fig. 9. Sturdy construction is essential for lift truck platforms, which undergo severe knock-a-bout service in daily use.



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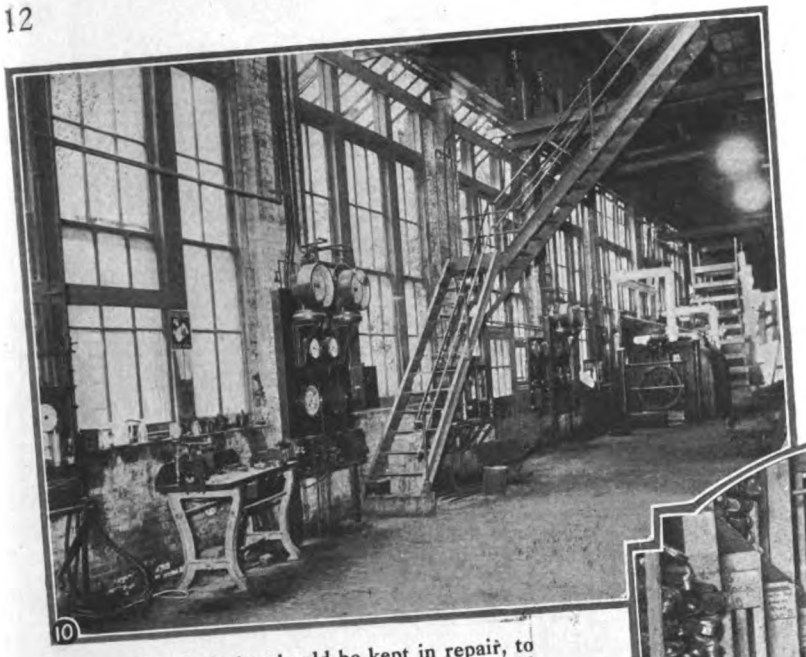


Fig. 10. Stairs should be kept in repair, to avoid accidents, and worn treads should be replaced before they become dangerous.



Fig. 11. The damage done to work on benches by rain, leaking through neglected sash, is more than enough to pay for proper care of such details.

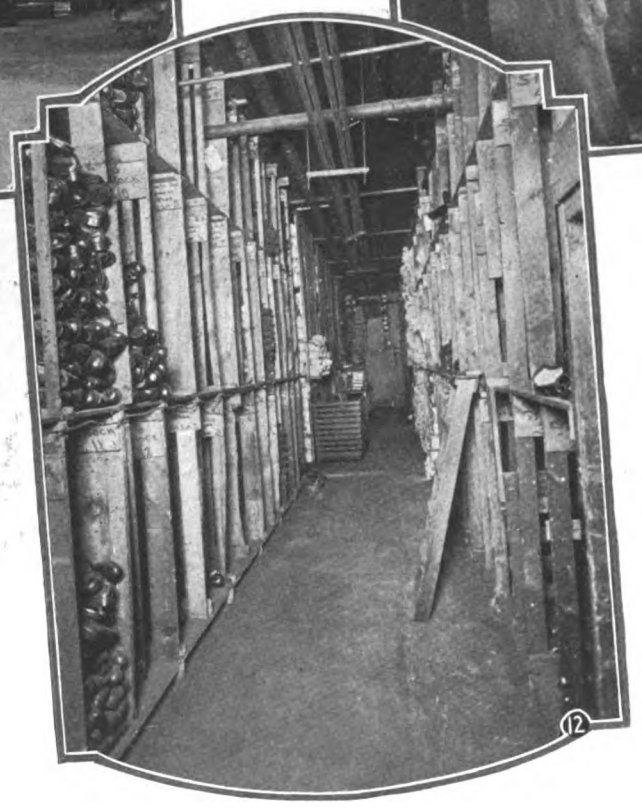


Fig. 12. Cheap in first cost, such storage bins as these often prove more costly in the long run than the portable, adjustable steel bins which have many desirable features.

floor only it is usually comparatively easy to put in extra posts or lally columns in the basement. On the upper floors, however, these extra posts would interfere with machinery, and reinforcing beams are placed at the sides or under the old beams and the columns reinforced proportionally. Good, sound lumber, free from shakes, is the only kind that should be used in any framing work of this kind. It should be seen to that the ends of beams in brick walls are exposed to the air to avoid rotting. The places where decay usually sets in are at the ends of beams and at post caps and beam hangers.

Stairs should be kept in good repair to avoid accidents. Worn treads should be replaced before they go too far. Safety treads frequently become loosened on concrete stairs and they should be grouted in place. Safety treads on wooden stairs can be easily replaced when worn. The wooden floors or decks on bridges are subject to constant wear from trucks and will require frequent attention. Bridges are usually covered with corrugated galvanized iron or some of the asbestos protected corrugated sheets in order to conserve the heat in the buildings at either end.

Stock racks are of two types, the open shelving or closed bins. Up to a comparatively few years ago all stock racks were of wood, but the modern ones are of all steel construction. These steel racks cost more in the initial investment but under rough usage they certainly last longer than wood. They also can be taken down and re-erected as many times as necessary without any injury to the rack. The shelf heights are easily adjustable and intermediate spacers may be put in if desired. On account of the much smaller size of the steel supporting members they hold an appreciably larger amount of goods than wooden racks of equal strength. The adjustable feature is very important when changes in stock requirements are made. Steel racks require little maintenance: the bolts should be tightened up occasionally and the racks should be kept plumb. Wooden racks are apt to have cracked boards and these should be replaced when the break occurs. The racks should be kept well braced if they are heavily loaded and they, too, should be kept plumb. On high racks, ladders on rails are often used. These rails and the fittings on the lad-

(Continued on page 31)



Fig. 13. Work benches require periodic attention, and it is often economic to make only the front part of a bench of hardwood; this being the part on which the actual work is done.



Fig. 14. The plant "carpenter shop" may consist of merely a bench and a few tools, or may be a fully equipped woodworking shop, depending upon the size of the plant it serves.

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A Challenge to Main Street

Shawsheen Village—A Modern Industrial Community

By Hugo Diemer

(Director, LaSalle Extension University)

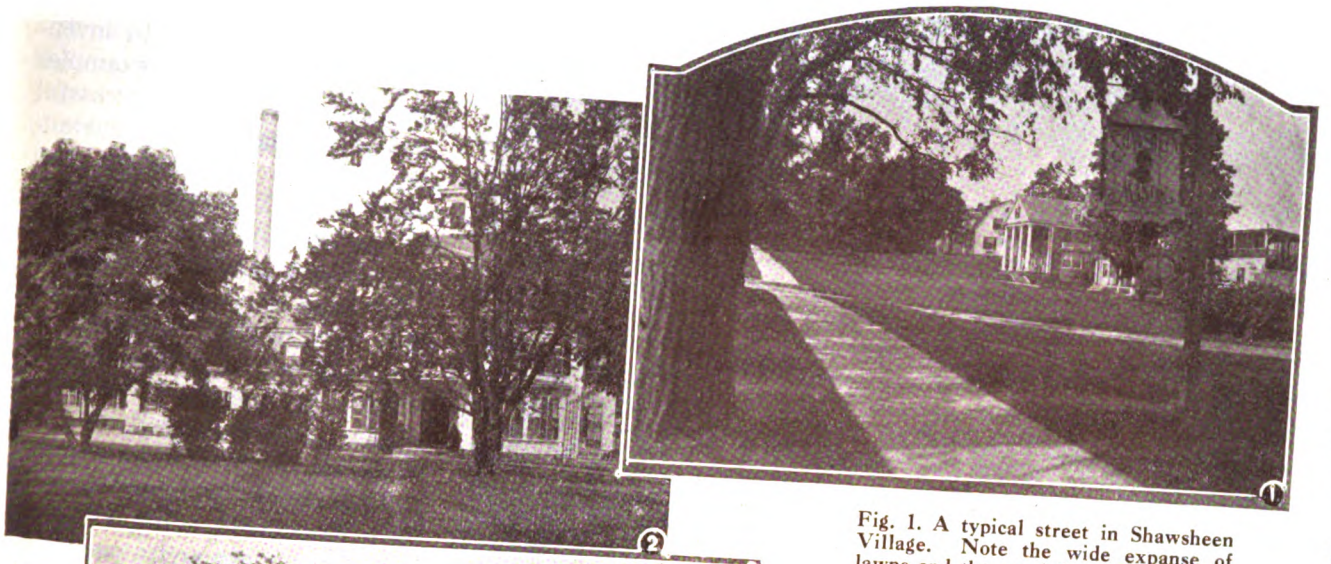


Fig. 1. A typical street in Shawsheen Village. Note the wide expanse of lawns and the careful spacing and setting.



Fig. 3. The Balmoral Spa Building. The ground floor is occupied by a splendidly furnished and stocked pharmacy, candy store and soda fountain. The upper floors are rented as business and professional offices. At the right of the building, not shown in the photograph, is a spacious outdoors, cement and waxed dancing floor.

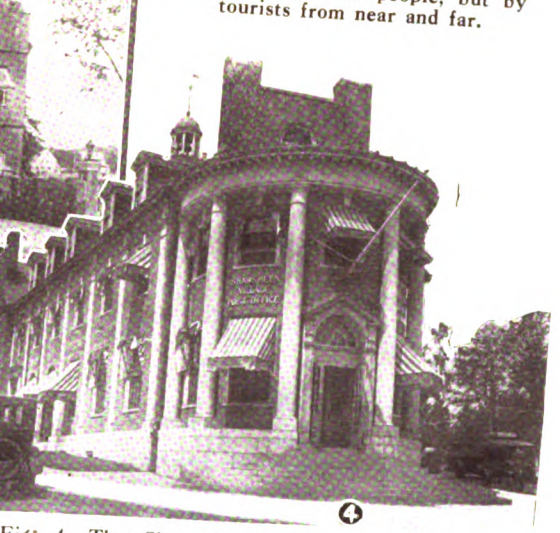


Fig. 2. The Shawsheen Manor, an excellent tavern which is patronized not only by local people, but by tourists from near and far.

Fig. 4. The Shawsheen Village Post Office. Note the fine colonial lines fitted to modern architecture.

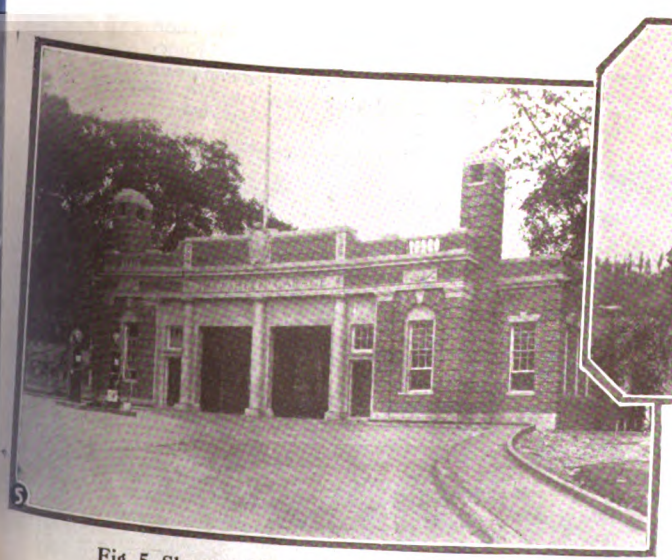


Fig. 5. Shawsheen Garage. A type that might well be copied by prosperous garage owners elsewhere.



Fig. 6. The Boys' Club. Note the attention to fine, artistic detail in planting and outdoor furnishing.



Fig. 7. The Shawsheen Laundry Building. Another example of providing a handsome building with fine setting for an institution which is apt to be an eyesore.

During the War it was the writer's fortune to be assigned to the position of Officer in Charge of Army Work in Lowell, Mass., and vicinity. Business trips and Sunday recreation drew me to travel, occasionally, the old Reading Turnpike to Andover, a delightful drive past many of the finest types of old New England homes characterized by the thoughtful attention of their occupants to trees, lawns, hedges, shrubbery and gardens.

It was only natural that, five years later, while touring New England, I should follow this old turnpike once more. What was my surprise when I entered what, to all appearances, was a beautiful, old-time village of which there had not been a trace when I passed over the road five years before. Naturally, I stopped off and made inquiries and found that I was in Shawsheen Village, one of the best conceived and carried out plans of community development in connection with an industry, where the American Woolen Company has created a beauty spot that stands as a model for projects of this nature.

Since company housing of employees had its beginning in New England, where the pioneer manufacturers erected their mills near water power, it is only natural that the development of housing to its highest state of perfection might be

(*Continued on page* 61)

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Minimizing the Invest

How the General Electric Company

BY JOHN

SINCE the war and its economic after effects have ushered in the new period of higher price levels, much attention is being paid to inventory control. Many examples can be quoted of successful profit building through curtailment in investment in raw materials. The first requisite to the minimizing of this investment lies in intelligent ordering.

Perhaps in no other plant does this matter assume more importance than at the General Electric Company's Schenectady Works. It is sufficiently difficult to devise an efficient raw material control system for the ordinary plant with a limited number of products and a small variety of materials. Imagine then the problem that obtains at this plant where the products embrace an almost infinite variety, from microscopic X-ray parts, to huge turbo-generator units of 60,000 horsepower. Here the raw material list runs the gamut alphabetically from Aluminum to Zinc, and in value from pig iron to platinum.

At Schenectady, the routine of ordering and tracing is under the jurisdiction of the Order and Stock Department, which is the connecting link, so to speak, between the Production Departments and the Purchasing Department. The Order and Stock Department receives requisitions from the factory for materials and purchased supplies required, approves and transmits these to the Purchasing Depart-

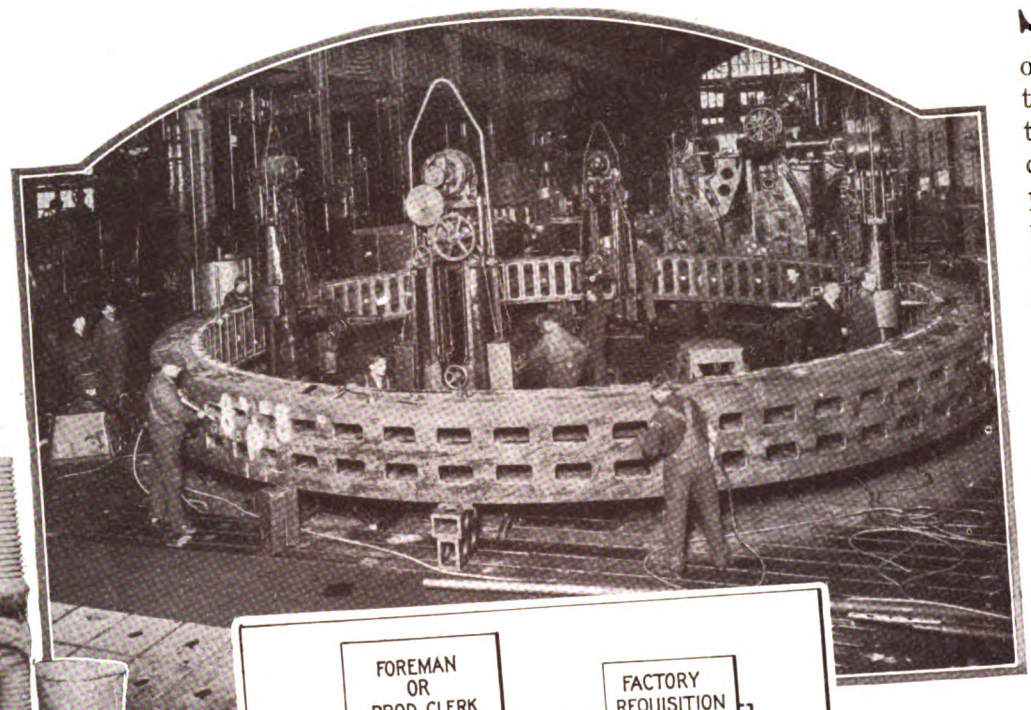


Fig. 1. Extreme variety reigns supreme at Schenectady. This huge generator casting represents one extreme.

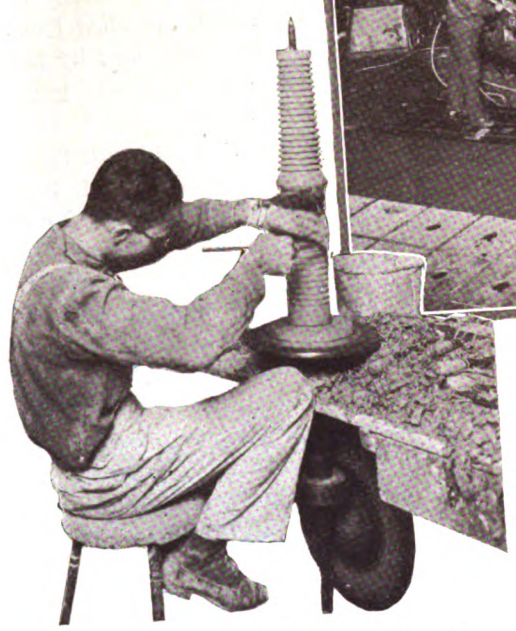


Fig. 2. The potter's wheel of Pharaoh's time is in daily use in molding porcelain insulator bushings.

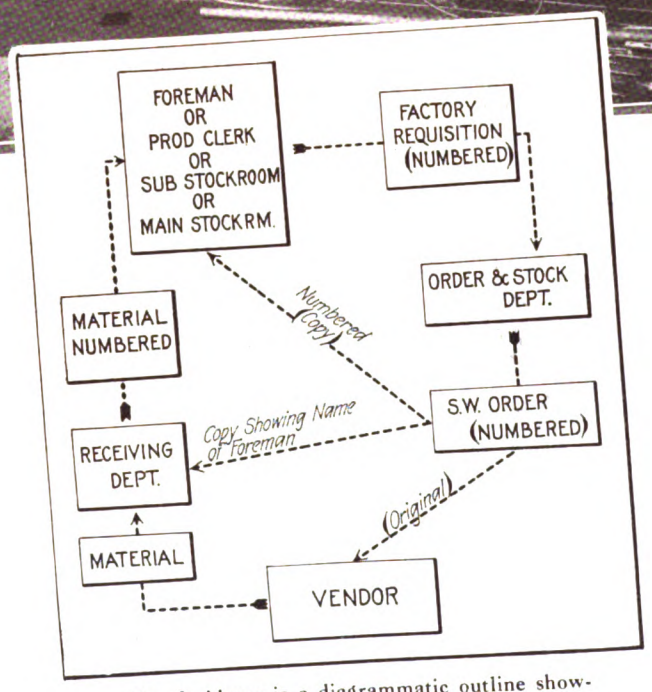


Fig. 3. Above is a diagrammatic outline showing the general routine in the cycle of raw material ordering and delivery.

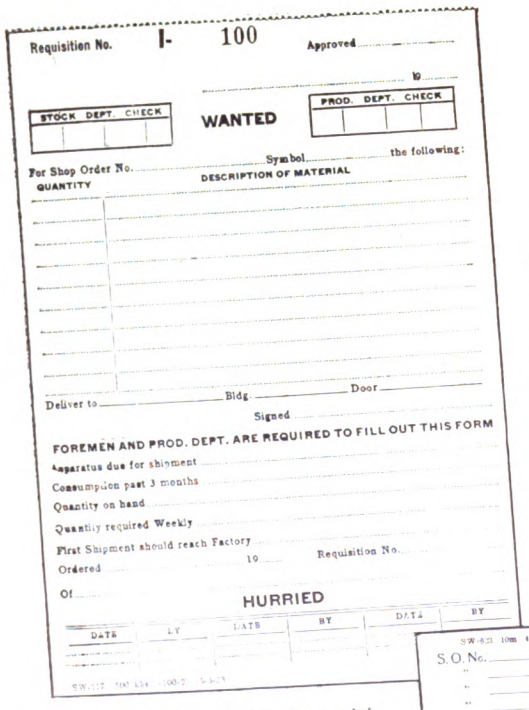


Fig. 5. The original requisitions come from various parts of the works and are sent to the Order and Stock Department.

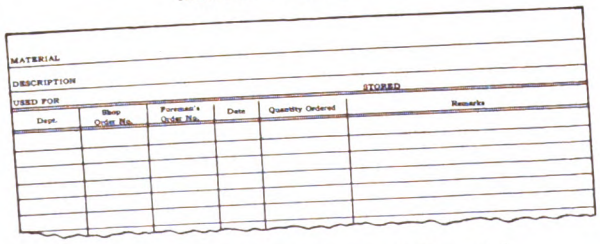


Fig. 4. A card record is kept of all requisitions for standard materials in the form shown above.

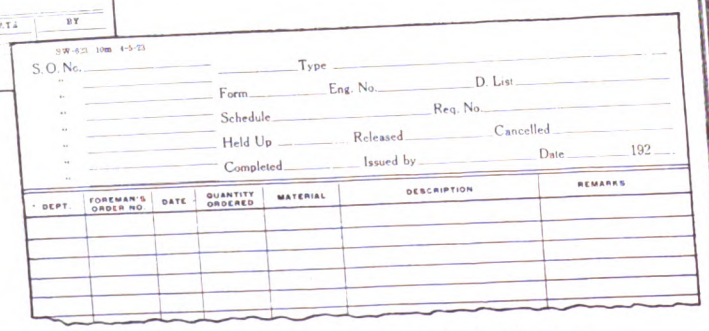


Fig. 6. A shop order record is also kept on which the requisitions pertaining to every order number are listed.

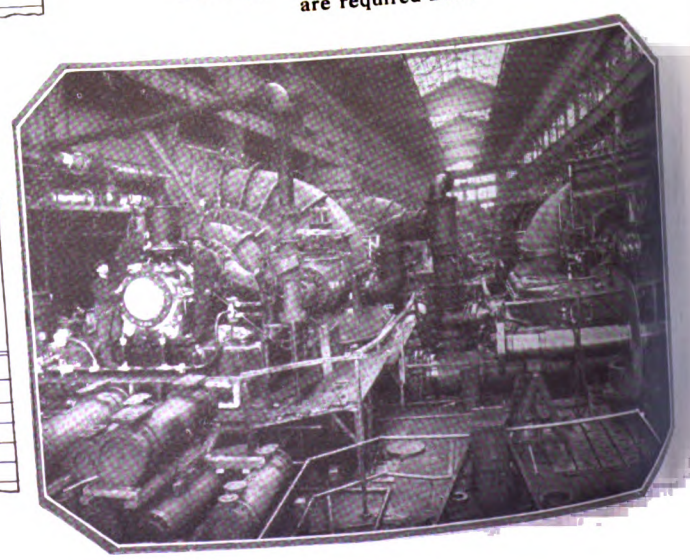


Fig. 7. Below is a view of one of the main bays in the turbine department. Enormous quantities and varieties of materials are required here.

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ment in Raw Materials

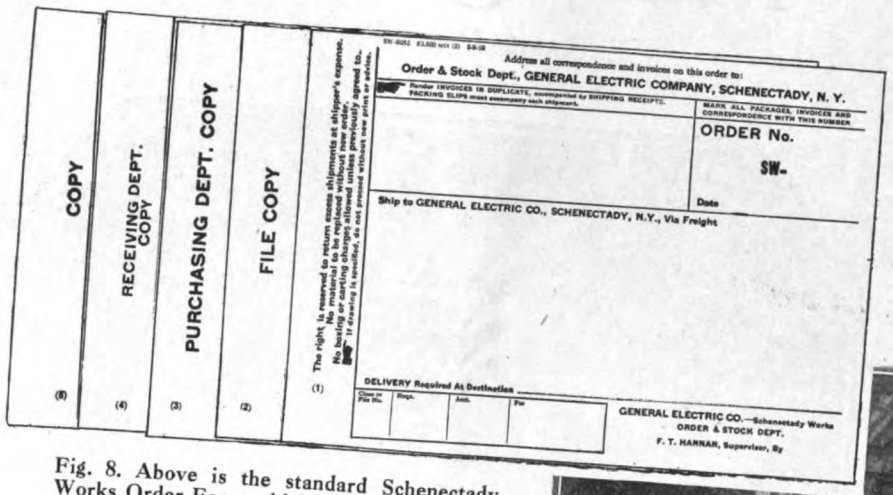
Handles Its Ordering Routine

HERBERT

ment and after the orders are placed assumes responsibility for the delivery of such materials when and as required.

A composite picture of the high spots in the routine employed by this department is depicted on these pages. So efficient is the system that is employed and so effectively is it operated that it is very seldom that production is delayed because of lack of suitable raw materials. This statement takes its proper emphasis when it is understood that the Schenectady Works comprise some twenty or more different factories, that the materials involved run into millions of dollars per month and that every precaution is exercised to prevent overstocking.

Quantities handled under this routine annually form a prodigious total. In the wire drawing and cable insulating departments, copper must be provided for nearly one hundred billion feet of wire and cable. Some fifteen thousand switchboard panels, thirty-five thousand induction motors, ranging from ten to two thousand two hundred horsepower, eighteen thousand controllers per year, tens of thousands of X-ray tubes, and thousands upon thousands of other items in similar impressive quantities comprise an aggregate which represent over one hundred thousand shipping orders and fifteen thousand cars loaded per year. The shipping department alone uses fourteen million feet of lumber a year and a ton and a half of nails a day.


COPY (6)
RECEIVING DEPT. COPY (4)
PURCHASING DEPT. COPY (3)
FILE COPY (2)
(1)

Address all correspondence and invoices on this order to:
Order & Stock Dept., GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.
Render INVOICES IN DUPLICATE, accompanied by SHIPPING RECEIPTS. PACKING SLIPS must accompany each shipment.
MARK ALL PACKAGES, INVOICES AND CORRESPONDENCE WITH THIS NUMBER
ORDER No.
SW-
Date
Ship to GENERAL ELECTRIC CO., SCHENECTADY, N.Y., Via Freight
DELIVERY Required At Destination
GENERAL ELECTRIC CO.—Schenectady Works
ORDER & STOCK DEPT.
F. T. HANNAN, Supervisor, By

Fig. 8. Above is the standard Schenectady Works Order Form which is sent to the vendor. Copies are distributed to departments concerned.



Fig. 9. At the right is one of the smaller motor departments. More than one hundred different materials are required in the construction of an electric motor.

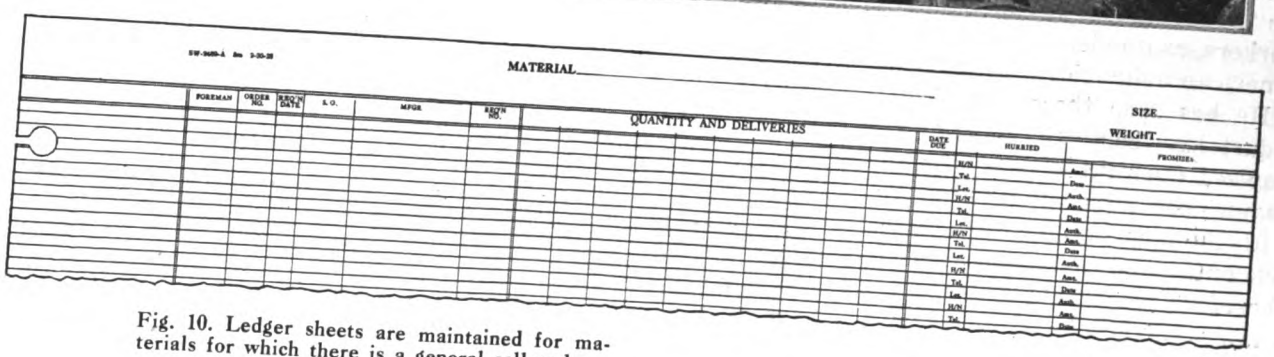
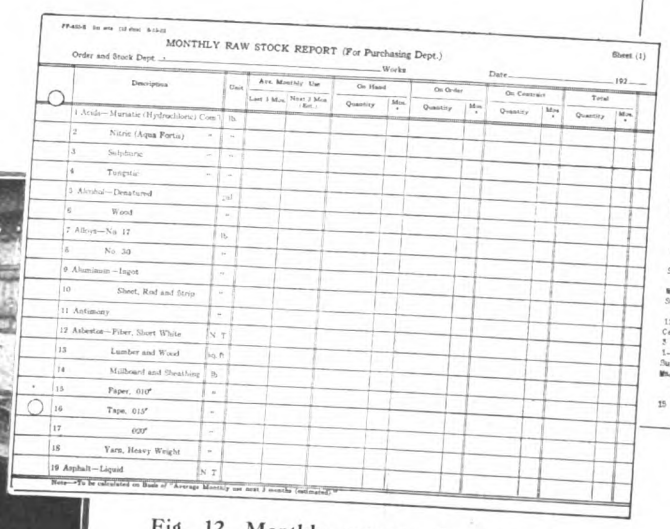

MATERIAL
SIZE
WEIGHT
FOREMAN | ORDER NO. | REQ'N DATE | E. O. | MFGR. | REQ'N NO. | QUANTITY AND DELIVERIES | DATE DUE | HURRIED | PROMISED

Fig. 10. Ledger sheets are maintained for materials for which there is a general call and are used for tracing purposes.



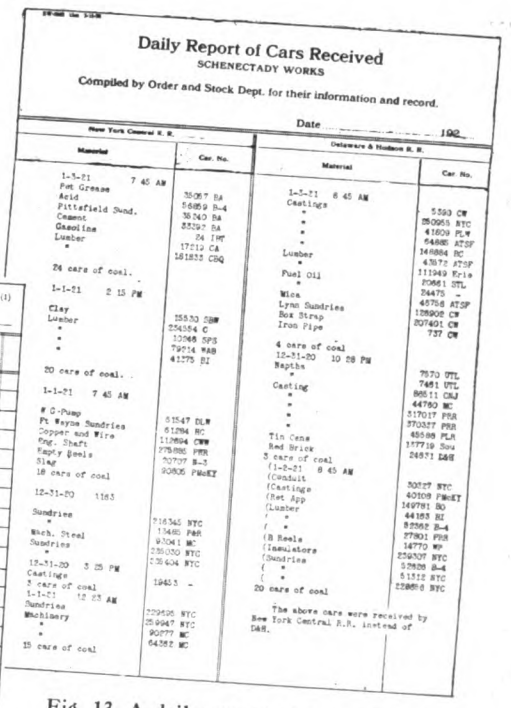
Fig. 11. Below is a view in the X-ray department where glass, tungsten and rare materials are required.


MONTHLY RAW STOCK REPORT (For Purchasing Dept.)
Order and Stock Dept. — Works — Date — 192 — Sheet (1)

	Description	Unit	Ave. Monthly Use: Last 3 Mos.	Ave. Monthly Use: Next 3 Mos. (Est.)	On Hand: Quantity	On Hand: Min.	On Order: Quantity	On Order: Min.	On Contract: Quantity	On Contract: Min.	Total: Quantity	Total: Min.
	1 Acids—Muriatic (Hydrochloric) Com'l	lb.										
	2 Nitric (Aqua Fortis)	"										
	3 Sulphuric	"										
	4 Tungstic	"										
	5 Alcohol—Denatured	gal.										
	6 Wood	"										
	7 Alloys—No. 17	lb.										
	8 No. 30	"										
	9 Aluminum—Ingot	"										
	10 Sheet, Rod and Strip	"										
	11 Antimony	"										
	12 Asbestos—Fiber, Short White	N. T.										
	13 Lumber and Wood	sq. ft.										
	14 Millboard and Sheathing	lb.										
*	15 Paper, .010"	"										
	16 Tape, .015"	"										
	17 .020"	"										
	18 Yarn, Heavy Weight	"										
	19 Asphalt—Liquid	N. T.										

Note—To be calculated on Basis of "Average Monthly use next 3 months (estimated)"

Fig. 12. Monthly reports of raw stock comprising 228 numbered items are made to the Purchasing Department.


Daily Report of Cars Received
SCHENECTADY WORKS
Compiled by Order and Stock Dept. for their information and record.
Date ____ 192__

New York Central R. R.

Material	Car No.
1-3-21 7 45 AM	
Pot Grease	35067 BA
Acid	56859 B-4
Pittsfield Sand.	36740 BA
Cement	85297 BA
Gasoline	24 IMT
Lumber	17519 CA
"	181855 CSQ
24 cars of coal.	
1-1-21 2 15 PM	
Clay	15533 DBW
Lumber	254554 C
"	12966 SPS
"	79514 WAB
"	41275 BI
20 cars of coal.	
1-1-21 7 45 AM	
M G-Pump	51547 DLW
Ft Wayne Sundries	51284 BC
Copper and Wire	119894 CWW
Eng. Shaft	975886 PRR
Empty Reels	90707 B-3
Slag	90805 PMcKT
18 cars of coal	
12-31-20 1165	
Sundries	516345 NYC
Mach. Steel	13485 P&R
Sundries	97041 MC
"	250350 NYC
12-31-20 3 25 PM	230404 NYC
Castings	19453 "
3 cars of coal	
1-1-21 12 25 AM	
Sundries	209496 NYC
Machinery	25 9947 NYC
"	90077 MC
"	64582 MC
15 cars of coal	

Delaware & Hudson R. R.

Material	Car No.
1-3-21 6 45 AM	
Castings	5393 CW
"	350955 NYC
"	41629 PLW
"	64685 ATSF
Lumber	146884 BC
"	43575 ATSF
Fuel Oil	111949 Erie
"	20661 STL
Wire	24475 "
Lynn Sundries	46706 ATSF
Box Strap	128906 CW
Iron Pipe	207401 CW
"	737 CW
4 cars of coal	
12-31-20 10 28 PM	
Naptha	
"	7570 STL
Casting	7491 STL
"	86511 CMJ
"	44760 MC
"	5170?7 PRR
Tin Cans	370357 PRR
Red Brick	45588 PLR
5 cars of coal	177719 Sou
(1-2-21 8 45 AM	26571 D&H
(Conduit	
(Castings	30527 NYC
(Set App	40109 PMcKT
(Lumber	149781 BO
/ "	44183 BI
/ "	55582 B-4
(B Reels	27801 PRR
(Insulators	14770 WP
(Sundries	259707 NYC
("	57626 B-4
("	51512 NYC
20 cars of coal	228616 NYC

The above cars were received by New York Central R.R. instead of D&H.

Fig. 13. A daily report of cars received is compiled and distributed by the Order and Stock Department.

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Patriarchal Versus Modern Shop Management

By James Wade Russell

THE writer of this article has been active in the industrial world for twenty years. He has been a machinist's apprentice, machinist, toolmaker, gauge-maker, foreman, superintendent and a teacher of mechanical trades and semi-trades, he has been and done practically everything in a manufacturing plant from sweeping the floor to managing the shop and the help.

He believes that his varied contacts and personal participation in manufacturing affairs have not destroyed his sense of proportion, or blunted his perceptions, or his appreciation for the advancement made in industry, as he is still active and knows the labor situation from the "green hands" to the skilled workers, as it exists today in our American industries.

He has seen these American industries completely revolutionized during the past twenty years, has associated himself with the men, foremen, superintendents and managers, and therefore he is in a position to know what is lost to our industries today and the remedy to overcome that loss through the mentorization of the personnel of our industrial institutions.

What is it that has been lost to modern industry?

Why is our labor restless, shiftless and dissatisfied?

In grandfather's day the "master" taught the boys how and why, but today the "master" is lost.



Fig. 1. It is usually advantageous to put the training section near the regular production work, as is done in the above instance.

Due to the rapid development of our large modern plants we find the "head" so far removed from the "man" that the contact is through an absent treatment method. The success of a plant's economical producing depends largely upon the information brought to the boss by subordinates, who do not always carry a true picture of the subject.

Managers are at a loss to understand why men become dissatisfied and quit; this causes them to set up "fences" in order to learn the cause, and then very often they see their plans go astray, because of the entrance of shop politics, or the inefficient working out of the system thus set up, which leaves the managerial heads more doubtful than before.

Years ago, when the Patriarch inducted beginners into his shop, he was very painstaking; learning all about the man's habits, ambitions, family connections and all other vital matters he wanted to know. There was a thorough and mutual understanding between "the party of the first part and the party of the second part."

Written agreements were worth the paper they were written on, and the boy's father and the master saw to it that the agreement was carried out. But

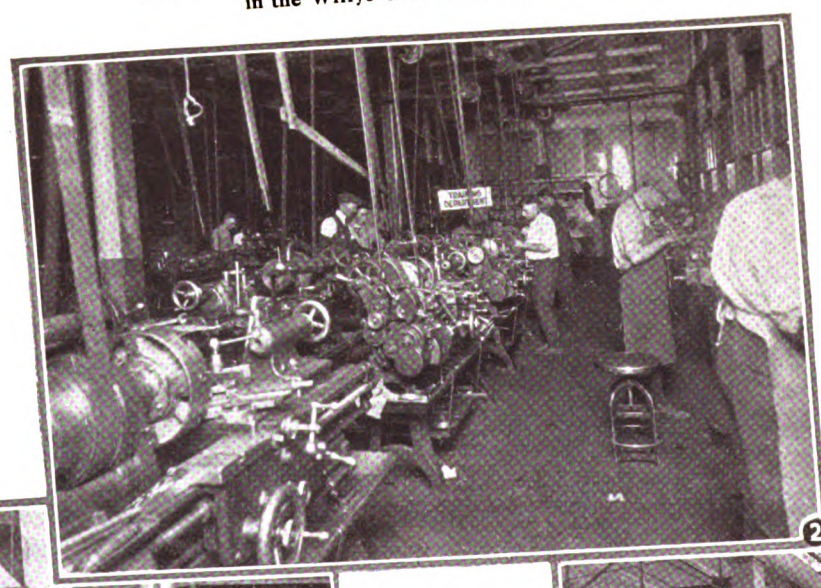


Fig. 2. Occasionally, where machines of one kind are scattered about the plant, the training for this kind of work has to be centralized—as shown below in the Willys-Overland plant.

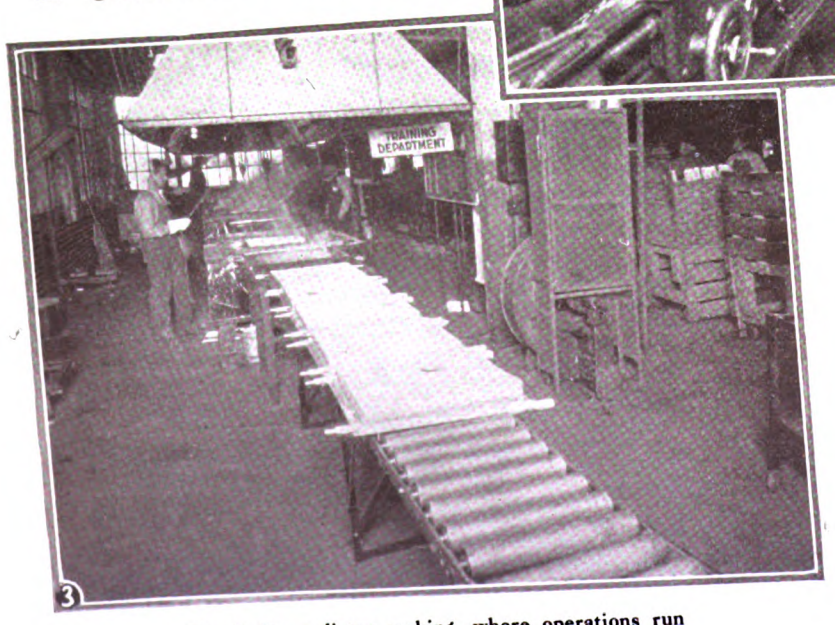
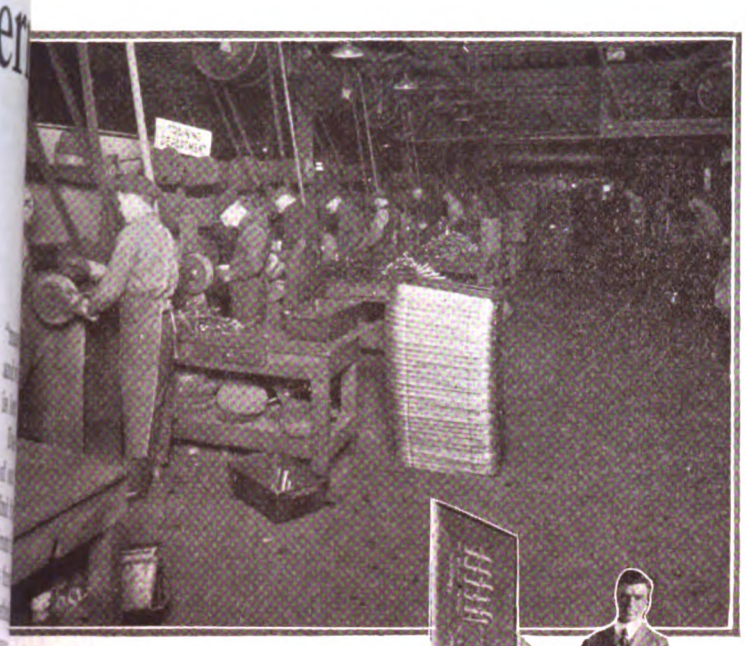


Fig. 3. On radiator making, where operations run into the hundreds, the training section is centralized, adjacent to the main shops.



Fig. 4. Training electrical wiremen, at the Winchester Repeating Arms Co., involved some knotty problems.

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. 5. Training department for pol-ers, adjacent to the production department.



Fig. 6. A "laboratory" for the training of electrical wiremen, Winchester Repeating Arms Co.



Fig. 7. Academic training in Company schools, to supplement the practical instruction.

the "master" is lost. r parent nor boss gives a r's dam" about the boy or elfare, resulting in the forking of labor into our and plants, and the terri-rest caused by not fitting an for the job, or maybe b for the man.

ly, men call at the employ-offices of our plants, and waiting for an interview, ie "educated" by the mob; ing how things stand to-what are the best paying and all the other "dope" the plant that the gang ly hands out. They have aster to guide them but are ed and influenced by the key man," who is always nt.

e Patriarchal master is lost dustry today, and a substi-must be found if harmoni-labor relations are to be anently established.

Training on the job" is the titute being used by some of our industrial managers today. Careful selection, guidance and training is the answer if we are going to fill the void left by the loss of the Patriarchal master.

We are all familiar with the results of one day's hiring at the average plant when labor begins to get scarce; ten per cent. hire out but never return; fifty per cent. that starts to work, quit cold the first day; one-half of those left, hang on for five or ten days and then "blow." The balance, that remain long enough for a fair trial, usually find conditions as represented and make good workmen.

Let us concentrate on the foregoing a moment. Some will say, "we are all familiar with the situation, but what is the answer, the way out?" By reading carefully you will learn how the turn-over in a large plant was reduced from 98 per cent. to 46 per cent. in two months and is still going down

(*Continued on page* 75)



Fig. 8. Teaching girls to wind silk on bamboo fishing rods; a problem which arose through the Winchester Repeating Arms Company's making new products.

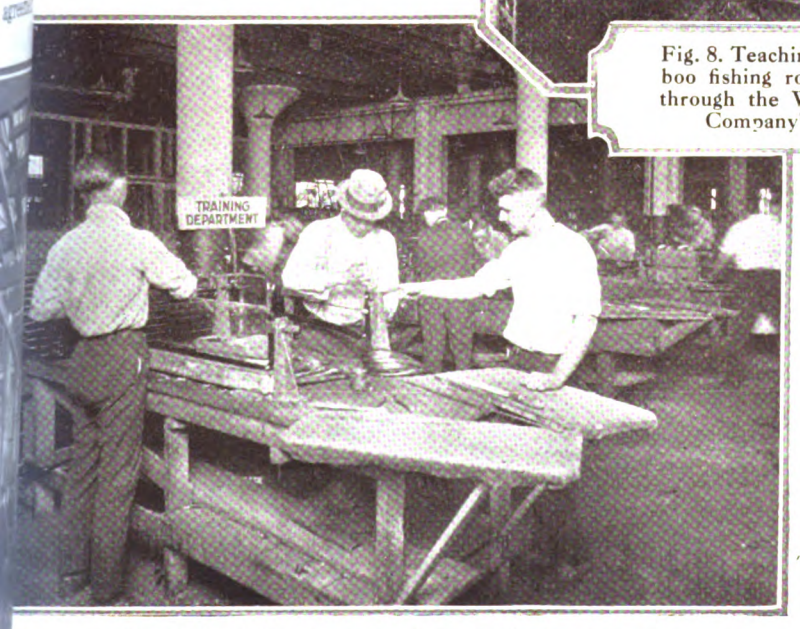


Fig. 9. Training future workers in the intricacies of windshield assembly, at the Willys-Overland Plant.

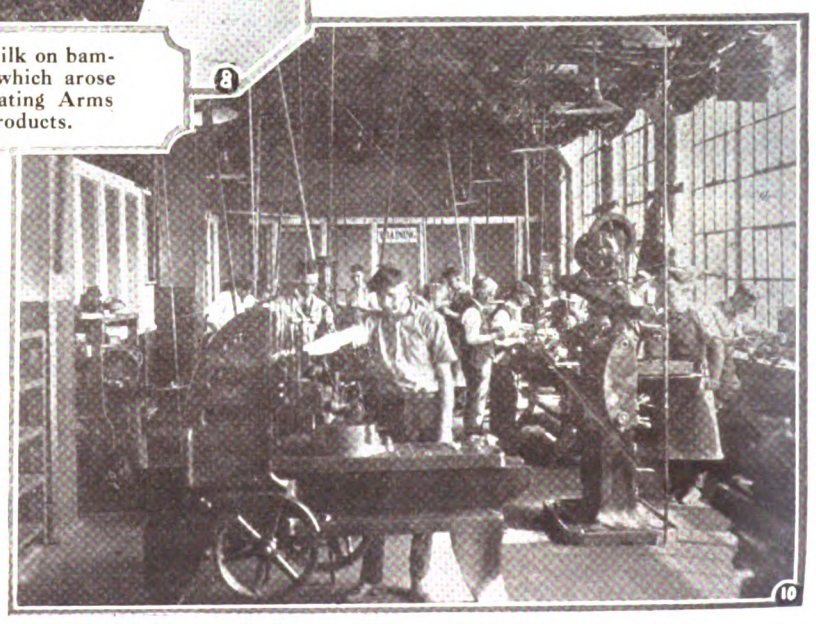


Fig. 10. Re-Training toolmakers who were rushed through the training during the war emergency.

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Helping to Solve the Nation's Transportation Problem

By Matthew W. Potts

In the February issue, car loading and unloading devices were described in order to show the methods of immediately releasing railroad equipment so that it could again be put into transportation service. There is, however, a new factor which has entered into the science of handling and transporting materials, namely: the motor truck and its accessories.

During the years 1916-1918, motor transportation developed very rapidly, and today the commercial value of the motor truck has advanced far beyond the knowledge of the proper way to use such equipment. The result is that many installations of this equipment are wasteful and represent a loss which could easily be turned into a saving.

In the case of production equipment, it is always considered essential that the equipment be kept continually busy, as idle time represents expense. This axiom also applies to motor trucks and it is therefore necessary to have accessories or auxiliar equipment to facilitate the loading and unloading of trucks, to increase their carrying capacity, and to make them interchangeable with and applicable as a part of, the present transportation systems.

On the loading of bulk materials from storage piles, we still find shovel gangs employed for loading the motor truck, and yet many companies are manufacturing portable loading equipment to perform this operation. Fig. 1 shows such equipment operating in a gravel pit on the loading operation. While it is necessary for men to shovel the gravel to the conveyor, the reduction in labor costs by its use is approximately 50%, as two men are employed instead of four, but the most important saving is in truck time, which amounts to about 33%. This item of 33% is figured if the trucks come on schedule time, but frequently the saving is more as the trucks will arrive at the pit in groups of two or three.

Some companies have found that the loading speed of this equipment is more or less governed by the men shovelling to the conveyor, and they have gone further in making the loading operation entirely mechanical. Fig. 2 shows a self-propelled, self-loading portable elevator which eliminates all shovelers, and is operated by one man. In the illustration a man is shown on the truck with a shovel, but if coöperation can be obtained from the chauffeur, this man whose duty it is to trim the load on the truck can be dispensed with. It has been found in actual practice that the self-loading portable elevators have reduced loading costs about 66%, and have made a saving in truck loading time of over 50%.

While the above equipment is separate and apart from the motor truck, there are many special appliances which can be attached direct to the truck, in order to make it more valuable. Among these may be mentioned power winches, which are used to aid in the loading and unloading of heavy objects, and swinging crane apparatus used to remove heavy objects from the truck platform, and on other operations.

A truck equipped with a power winch can be quickly loaded, and it is not necessary

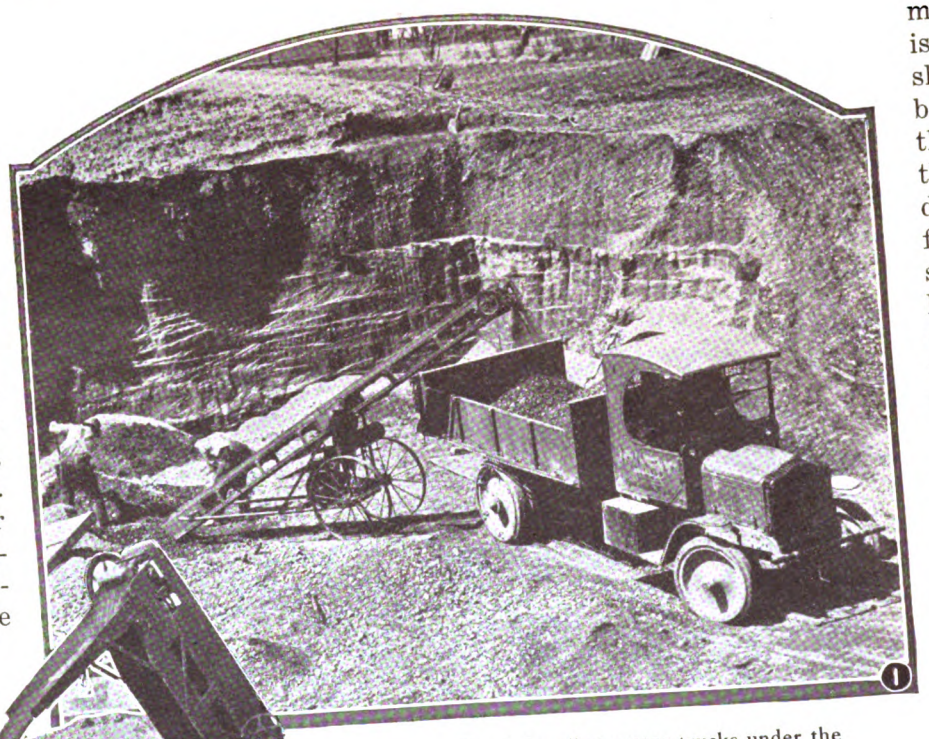


Fig. 1. Loading motor trucks under the above conditions with the ordinary shovel gang is expensive. The portable belt conveyor reduces loading costs.

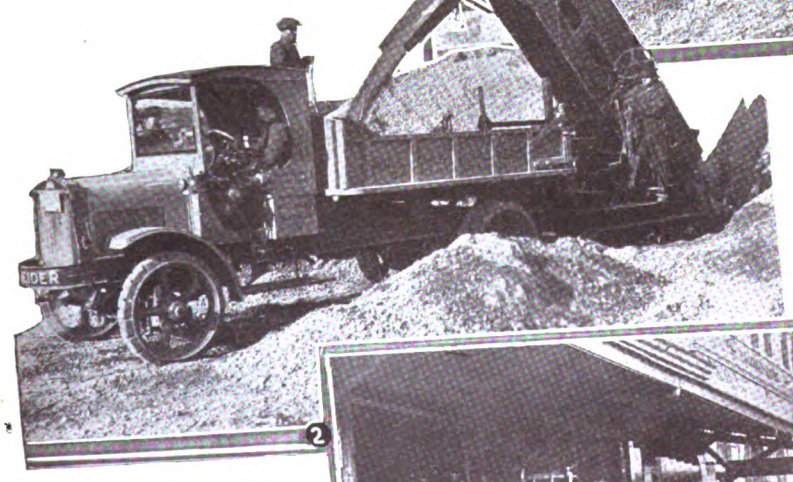


Fig. 2. A self-propelled, self-loading bucket elevator, which reduces loading costs still further.

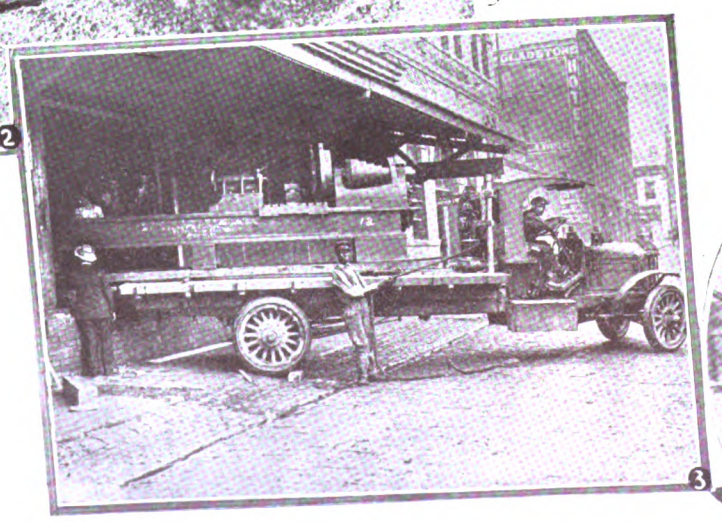


Fig. 3. Loading heavy machinery by hand power is slow and expensive. Let the motor do the heavy work.

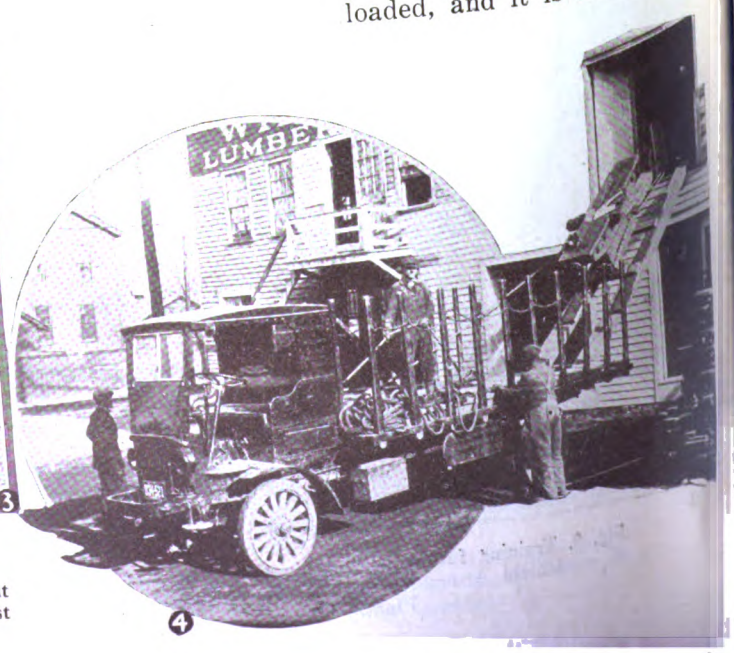


Fig. 4. Unloading to second story without the power capstan would require at least 10 men.

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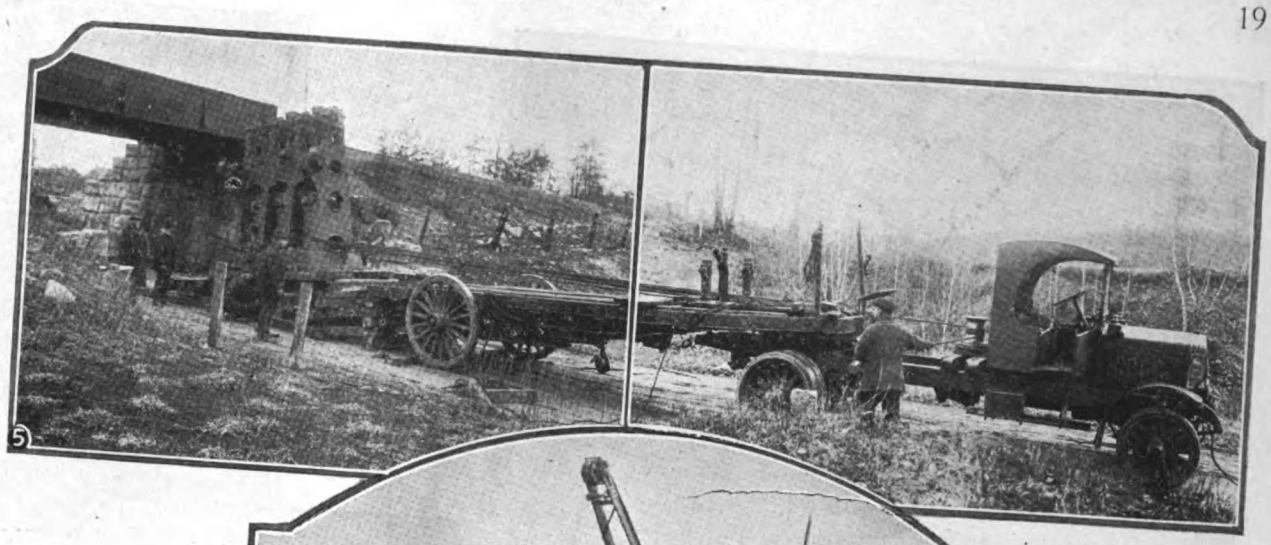


Fig. 5. Transportation is becoming a science, and mechanical power should be used wherever possible.

to carry along extra men or a rigging gang to accomplish the results shown in Fig. 3. In the case of Fig. 4, however, where a planer or other heavy equipment is being unloaded to the second floor of the building, it is frequently necessary to have extra men for placing the planks, fastening the snatch blocks, etc. The power winch, however, eliminates the slow, heavy labor of pulling the equipment up by hand, and as the power is derived from the motor engine, it is uniform and speedy, thus reducing the unloading time and permitting the truck to haul more loads per day. Many trucks owned by telephone companies, general hauling concerns, wreckers, and industrial plants are equipped with these devices.

Fig. 5 illustrates the value of proper equipment for motor transportation. In transporting this pump to the industrial plant, it was necessary to do so by motor truck. The pump was originally loaded on to the trailer at the railroad station. It had to be unloaded in order to pass under the bridge shown to the left. The power winch was used at the station, and also for unloading at the bridge. The motor truck and trailer was then run forward and planks were laid and the power winch pulled the heavy pump under the bridge and hauled it on to the trailer.

To those who have handled similar jobs, the savings in time

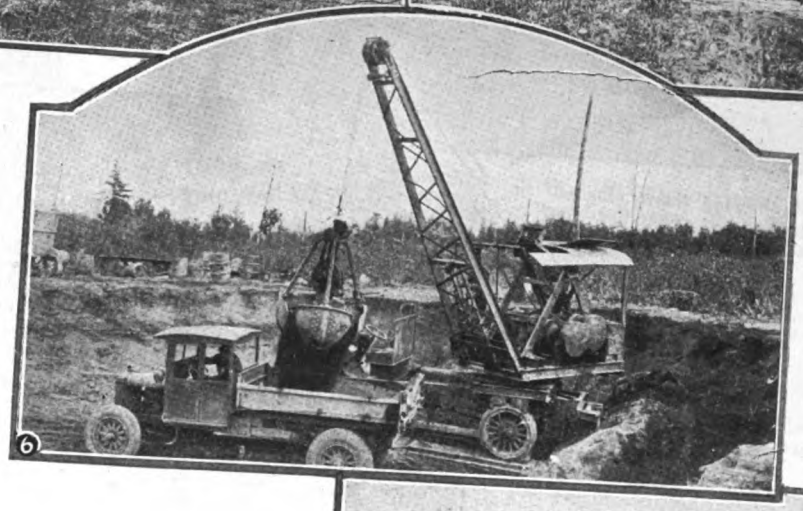


Fig. 6. Crane equipped with grab bucket and mounted on motor truck facilitates quick transportation between jobs.

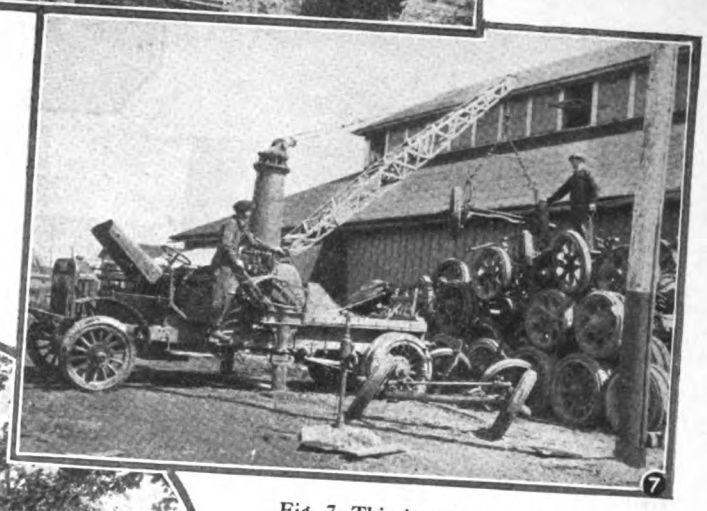


Fig. 7. This is a heavy crane job, but the truck engine is the only power unit required.



Fig. 8. Road building and contracting has made many new uses for the motor truck. Dumping direct to concrete mixer speeds up the work and reduces costs.



Fig. 9. Quick unloading is essential to bringing about efficient truck operation.



Fig. 10. Turn table bodies to permit side or end dump facilitates unloading in close quarters.

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Fig. 11. View showing trailer loaded with miscellaneous merchandise attached to motor truck for city delivery.

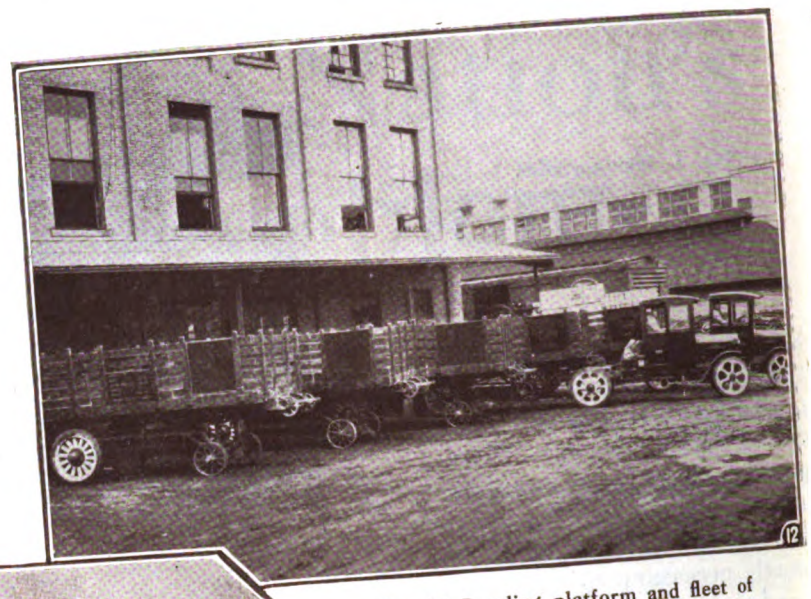


Fig. 12. Loading platform and fleet of trailers operating at the Buick Motor Company, Flint, Mich.



Fig. 13. This fleet of trailers and five trucks are performing the work of 15 trucks.

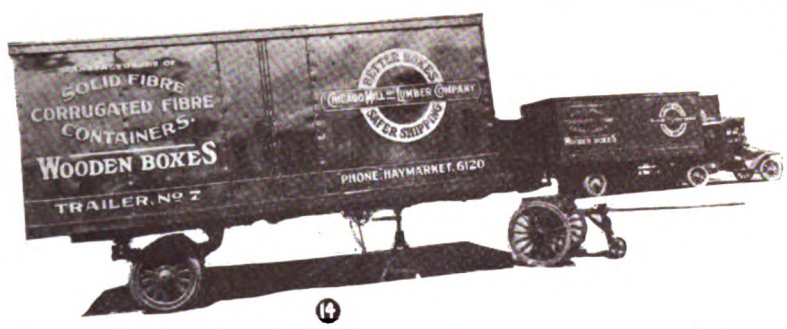


Fig. 14. Close-up view of one trailer shown in Fig. 13, and auxiliary front wheel for shifting trailers without the use of motor trucks.

and money effected by using the power winch instead of hand labor for these various handlings will be apparent without need for explanation.

Industrial plants have not contributed to the development of the motor truck, but they are now profiting by the experience of contractors and others who have made many uses of such equipment. Fig. 6 shows a crane mounted on a motor truck. Such a device would have many applications in a plant yard, etc. The crane in this case, however, is equipped with an orange peel bucket, and is employed by a contractor on road building. Three of these cranes, each handling approximately 550 yards of gravel in a 10-hour day, kept forty motor trucks busy during the past season on road work for one of the state highways. The contractor found that by having the crane mounted on a truck, it facilitated

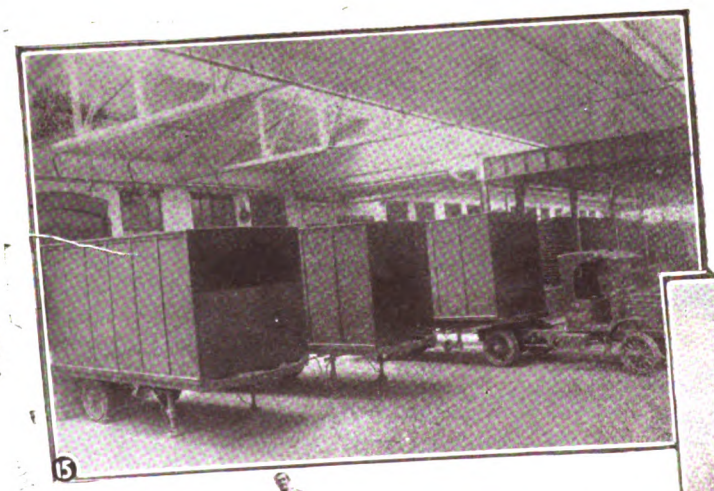


Fig. 15. Different type of trailer operating at the plant of the Western Electric Company.



Fig. 16. A four-ton trailer and 3-ton truck loaded with 12 tons of oranges leaving Lindsay, California, for Sacramento.



Fig. 17. The farmer is finding many uses for trailers in carrying produce to market.

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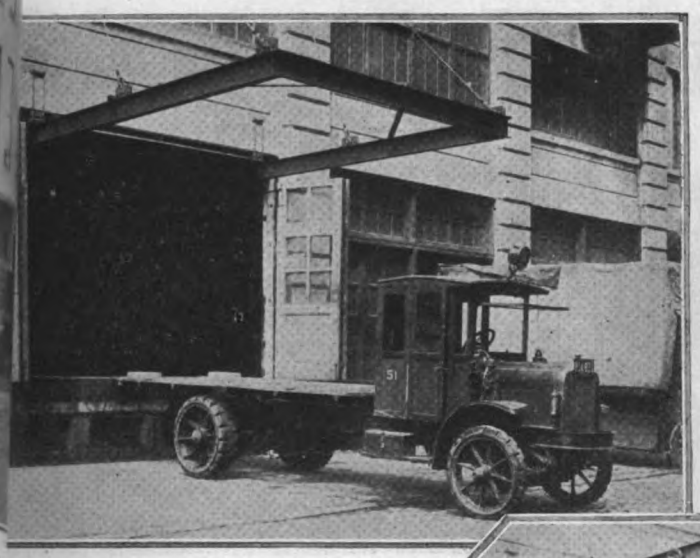


Fig. 18. Motor truck backed into position for loading.

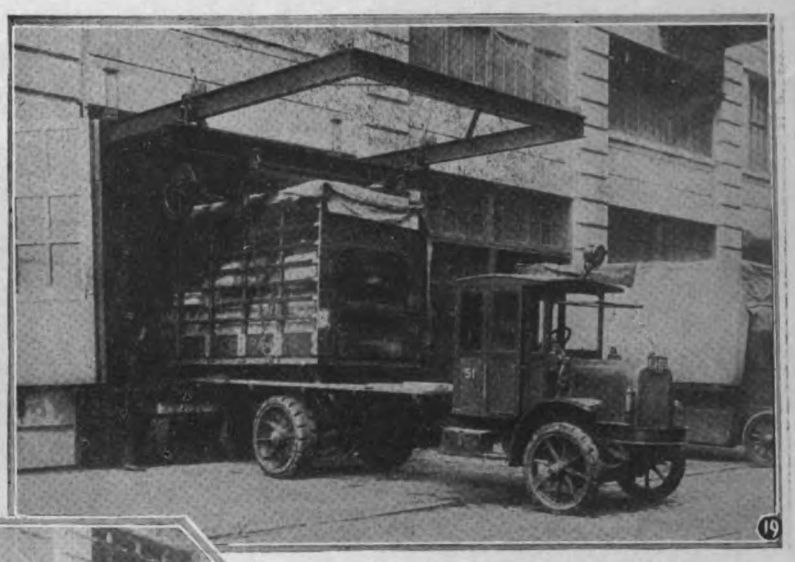


Fig. 19. Demountable body loaded in building being pushed into position on overhead tracks.

transportation between
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o relieve the load on the
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applications of cranes on
trucks and some indus-
ants, such as cable manu-
ers. foundries, etc., have
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eature of truck equipment
h that truck manufactur-
isually quote on chassis
ut bodies, thus permitting
ruck owner to equip his





Fig. 21. Showing demountable bodies in position for loading, where motor trucks back into building. Note the overhead tracks and body supports which permit longitudinal movement.



Fig. 22. Another type of demountable body which does not require overhead supports. One man, by turning hand crank, pulls body into position on truck.

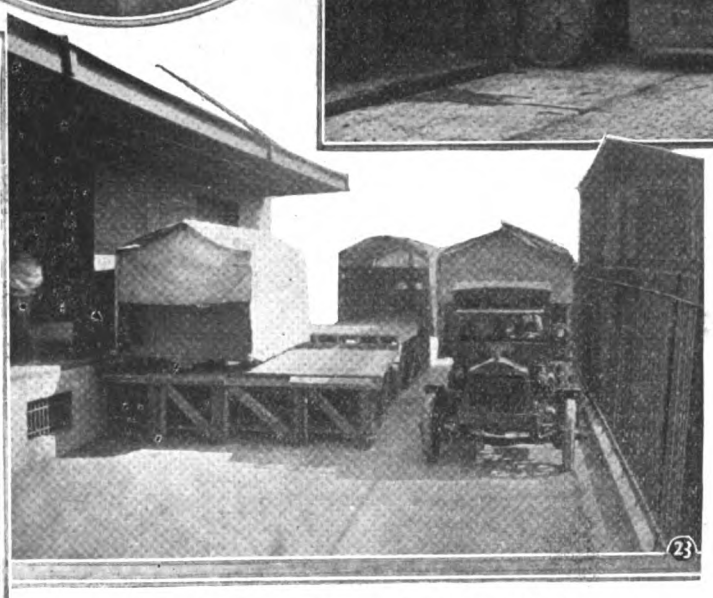


Fig. 23. View showing loading platform where demountable bodies are employed. This company, using two trucks and four bodies for city deliveries, effected savings of approximately 40%.

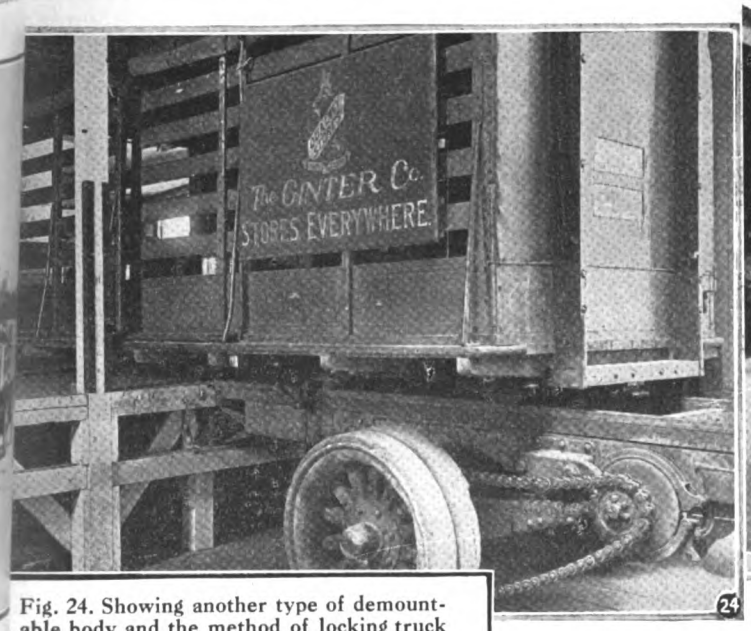


Fig. 24. Showing another type of demountable body and the method of locking truck to loading platform while body is being rolled on to or off of truck chassis.

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Fig. 25. A unit in the Nation's transportation system. Fleet of motor trucks employed in long distance hauling of moving of household goods.



Fig. 26. Same truck shown in 24, showing demountable body locked in position on truck chassis.



Fig. 27. European railroad systems have for many years employed demountable freight car bodies. This car is carrying containers filled with carbide.

chassis with whatever type best fits his needs. While there are many forms of bodies, they can be classed under the following types, open or express, stake or platform, enclosed or panelled, dump, tank, refrigerator, demountable, and special types. Each of these body types may have many modifications and forms of construction, size, shape and capacity, which makes it applicable for hauling a particular kind of commodity. Each of these forms are best suited to a certain application, depending on the class of commodity and conditions surrounding the installation. For instance, the platform truck can be used to best advantage for hauling heavy boxes and crates, the dump body for loose materials, such as coal, sand, gravel, etc.; the tank body for liquids such as oil and water, and the demountable or special construction under certain conditions.

Fig. 8 shows what is known as a mechanical dump body discharging material to a concrete mixer on road work, while Fig. 9 shows what is known as a hydraulic dump body discharging refuse from a city collecting truck to railroad cars for transportation.

Fig. 10 shows hand operated dump body, which is mounted on a turn table to permit the body dumping at any angle desired. This type of equipment facilitates operation in close quarters and should have many applications in industrial plants.

Plant executives who are operating a number of trucks for delivery between plants or to consumers should give thought to the use of trailers. As previously stated, when operating motor trucks the item of time spent in loading and unloading is often a most expensive one. It is imperative that this lost time be reduced to a minimum. The truck is too costly an article to be used as a loading platform, and should be kept under load

(*Continued on page 42*)

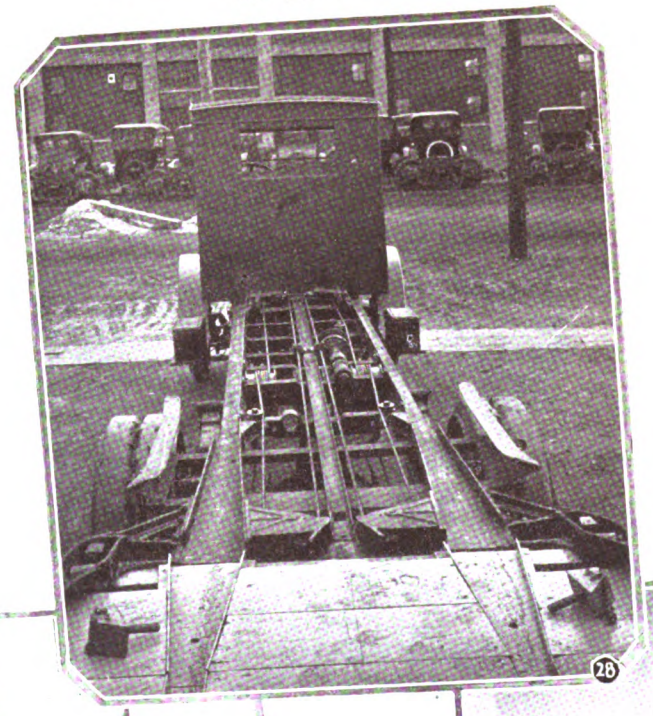


Fig. 28. A view of the Detroit United Railway motor truck at platform waiting for reception of demountable bodies. Note alignment of tracks on platform with those on truck. Also mechanical arrangement for pulling bodies on the chassis by power.

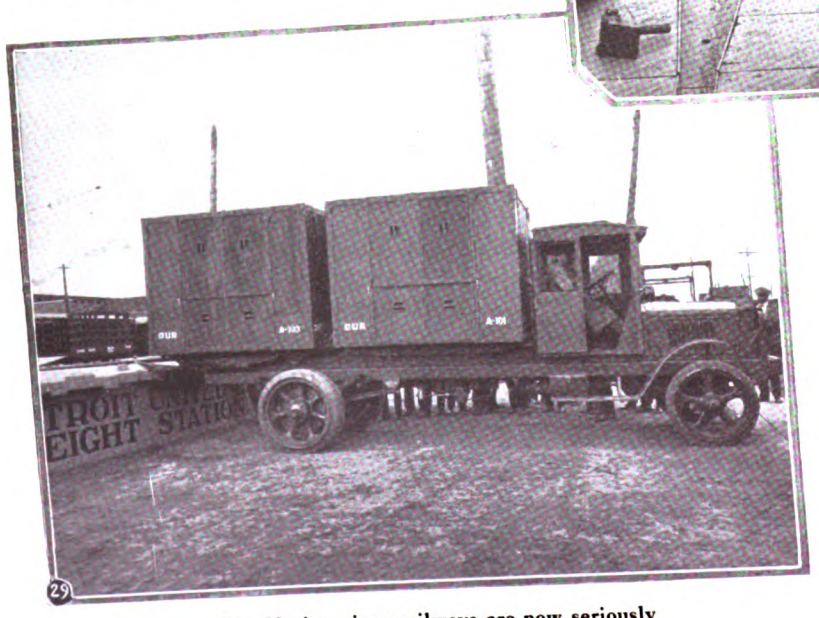


Fig. 29. American railways are now seriously considering the use of similar equipment. This illustration shows demountable bodies being unloaded to the platform of the Detroit United Railway Company.

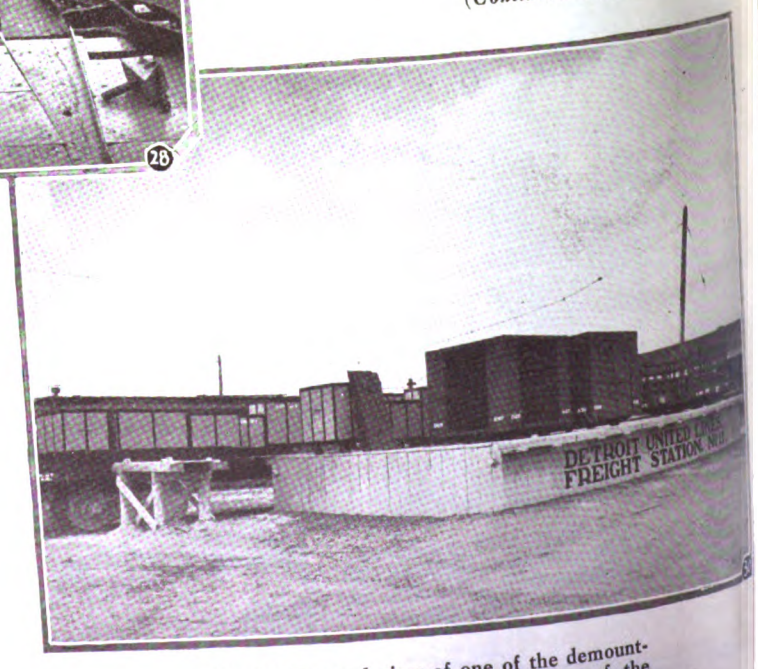


Fig. 30. General view of one of the demountable body container freight stations of the Detroit United Railway Co., showing various types of demountable bodies which are loaded directly on to flat cars or motor trucks.

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Modern Bearings and Their Lubrication Problems

By Allen F. Brewer.

vitals of the modern dustrial plant, its bear- gs; the secret of oper- fficiency, lubrication. o factors demand more tion from the Manage- What two factors influ- e markedly economical eration? Today, re- of machine design, the of equipment installed, pe of product involved, must be used. They heart of the machine, eir lubrication will de-

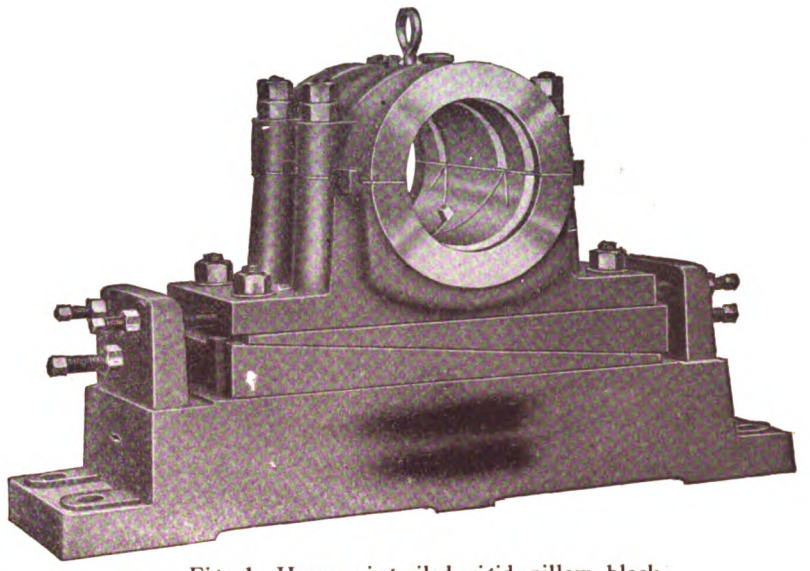
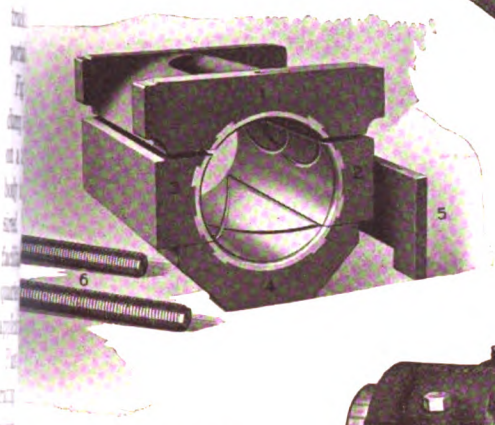


Fig. 1. Heavy ring-oiled rigid pillow block bearing. Note wedge adjusting plate.

pend the rate at which it can produce, and upon their performance under continuous and intensive operation will hinge the matter of machine maintenance and repair costs. Truly, bearings are important in every phase of our daily life wherever machinery is concerned. No wonder, therefore, that every effort is bent to develop them to as perfect a state as possible. Bearings may be few or many, according to the type and function of the machine; in any case, however, regardless of their number they are the salient factors involved in efficient operation.

Friction and its reduction enters markedly into this problem of bearing operation. To drive a machine, power must be expended in order to overcome the frictional resistance developed by its moving parts, or in other words, between its shafts, journals or slides, etc., and the bearing surfaces which support them. Accordingly, as the speed and operating pressure is increased the resultant friction will tend to increase. It can never be eliminated, naturally, or we might attain the wondrous goal of perpetual motion, but it certainly can be decreased to a decided extent by effective lubrication.

By solid friction, we understand the resistance to motion which occurs when two solids move over one another. This will vary naturally, according to the type of the solids involved. In general it will depend largely upon the smoothness of the sur-



etails of a four-piece owing the upper, lower shells and adjusting screws.

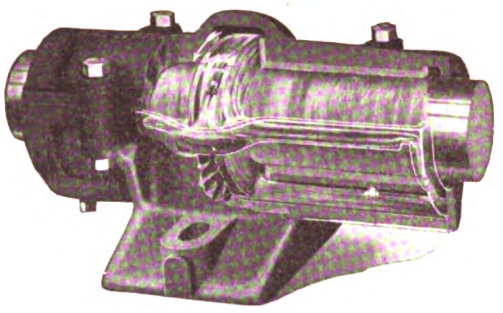
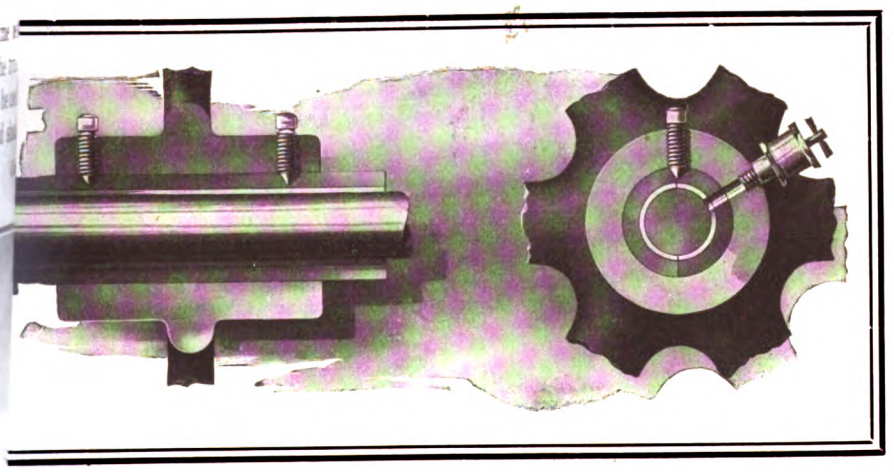
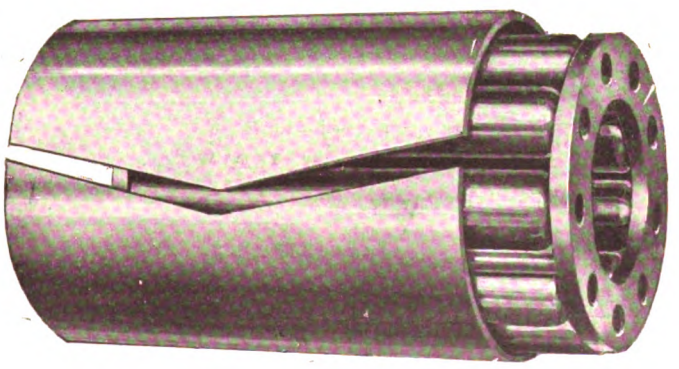


Fig. 3. Collar type of self-oiling bearing showing flow of oil.



Split sleeve and bushing as r friction clutch pulleys. Note ssion grease cup installation for lubrication.



Commercial type of roller bearing. See details in Fig. 6.

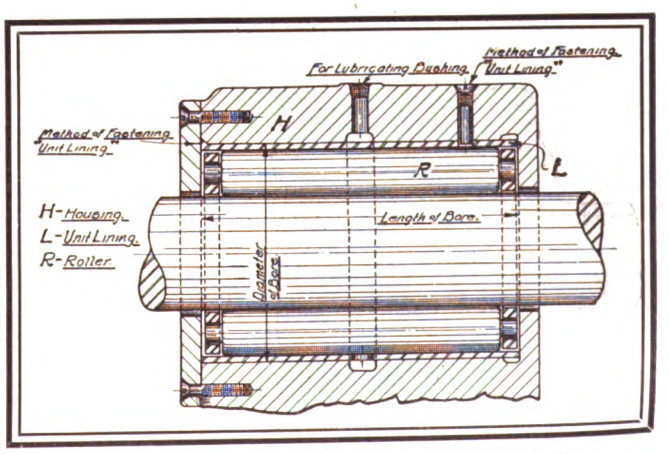


Fig. 6. Details of the roller bearing shown in Fig. 5.

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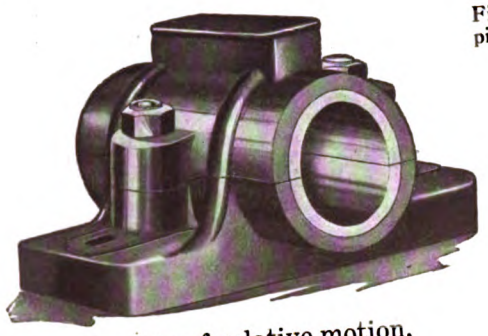


Fig. 7. Rigid wick oiling type of two-piece bearing, used as a pillow block.

faces, the rate of relative motion, and the pressure exerted by the moving element upon the stationary or bearing surface. The actual reason for the occurrence of solid friction is regarded as the presence of a relatively infinitesimal number of more or less minute elevations and depressions. According to the care observed in the machining of the surfaces the intensity of these irregularities can be somewhat controlled. On the other hand, they can never be eliminated, as examination of the most polished surfaces will show under the microscope. As a result, when one such surface is moved over another, the two being held in relatively uniform contact by means of externally applied pressure, the elevations of the one will tend to engage with the depressions in the other, molecular attraction tending to hold them together. In order to bring about sliding motion between these two surfaces, energy must, therefore, be expended.

The introduction of a film of oil between these surfaces, however, will compensate for the depressions and elevations, and therefore, keep the surfaces out of actual contact. Solid molecular attraction will thus be reduced to a great extent, and solid sliding friction replaced by the fluid friction of the lubricant, or, in other words the friction which exists between the particles or layers of this latter. So we can consider lubrication as the elimination of sliding or rolling friction by the formation and maintenance of a lubricating film be-

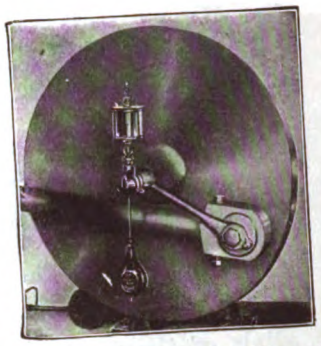


Fig. 8. Crank-pin center oiler equipped with oil cup, for the positive lubrication of crank-pin bearings.

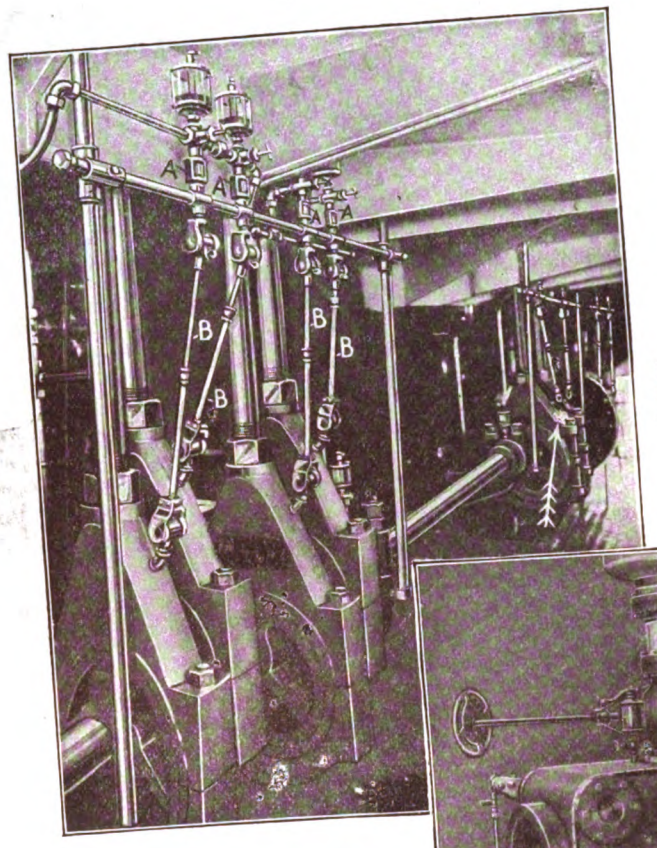


Fig. 9. Illustration of the method of lubricating eccentric bearings of a pumping engine by means of telescopic eccentric oilers.

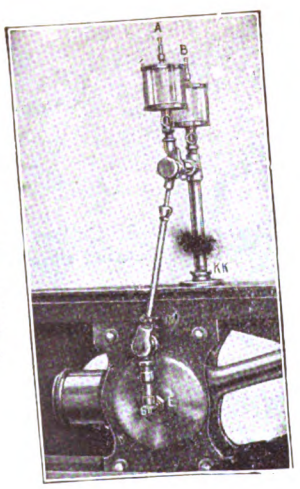


Fig. 10. Engine crosshead pins and guides demand positive and dependable lubrication if bearings are to function properly. The telescopic positive feed oiler shown above serves this purpose well.

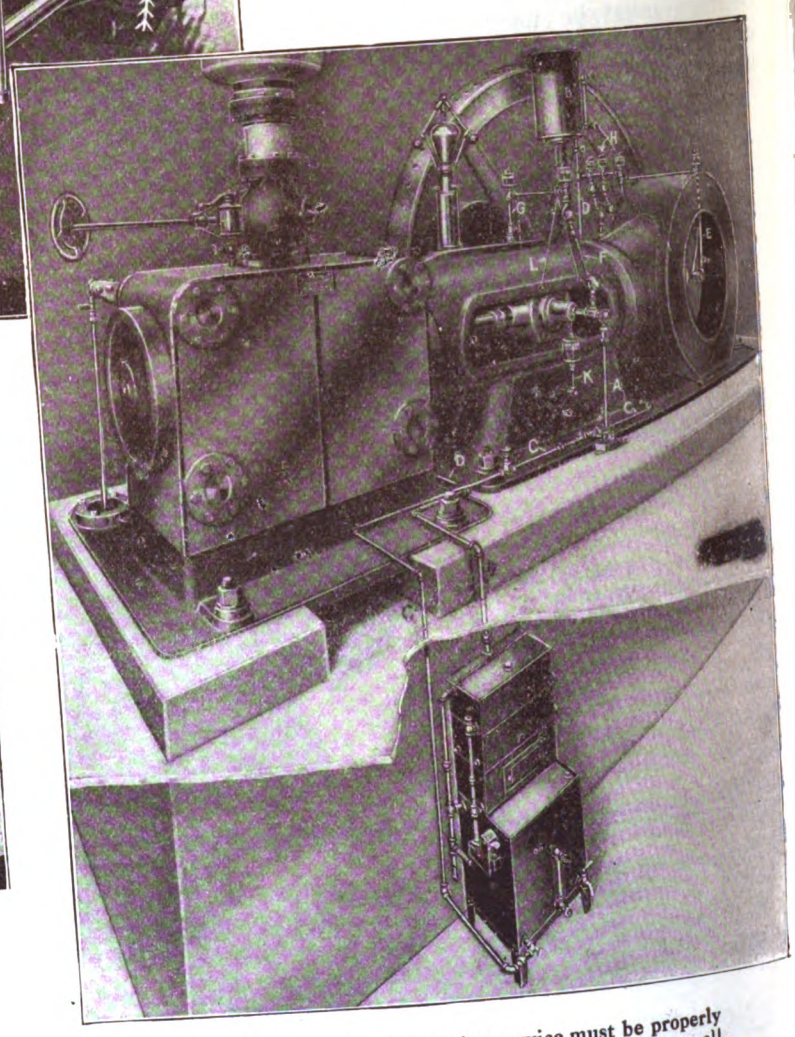


Fig. 11. Lubricants for bearing service must be properly filtered, etc., and often circulated continuously to all bearings. Therefore an automatic return gravity feed system as shown above, for engine service is of decided value.

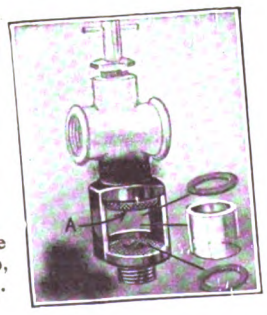


Fig. 12. Details of a removable glass, sight feed bearing oil cup, with glass removed for cleaning.

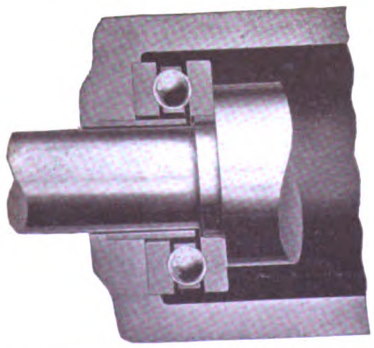


Fig. 13. Showing the method of application of ball bearings to a thrust bearing.

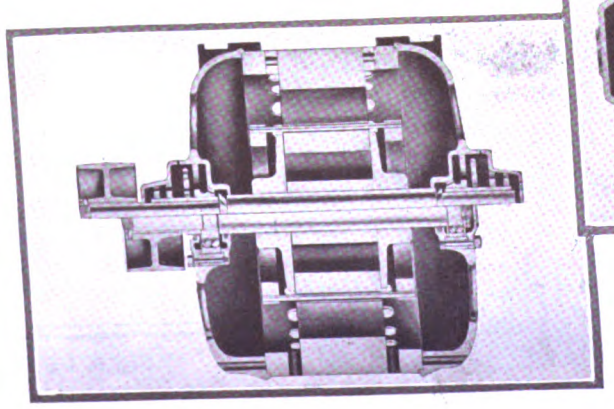


Fig. 14. Sectional view of a motor equipped with ball bearings. Lower half of shaft indicates length with ball bearings, the upper half the length with ring-oiled or plain bearings.

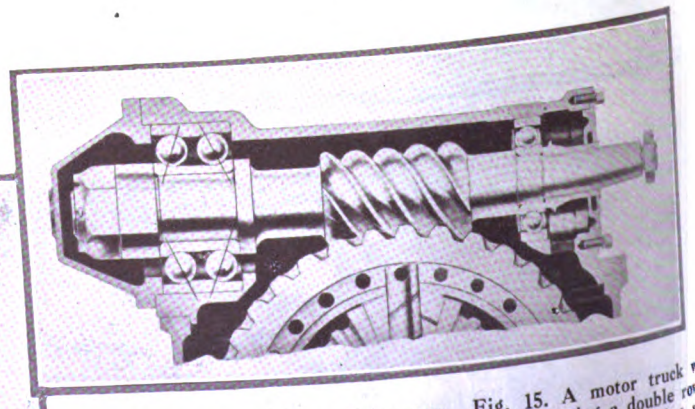


Fig. 15. A motor truck worm drive showing a double row radial thrust ball bearing which serves to carry combined thrust and radial loads.

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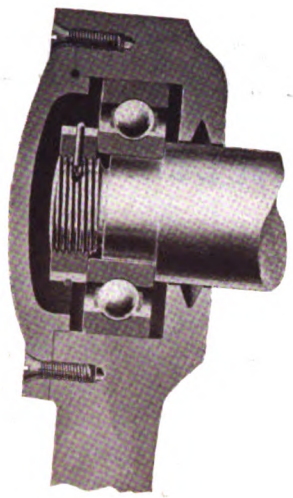


Fig. 16. A radial type single row ball bearing installation.

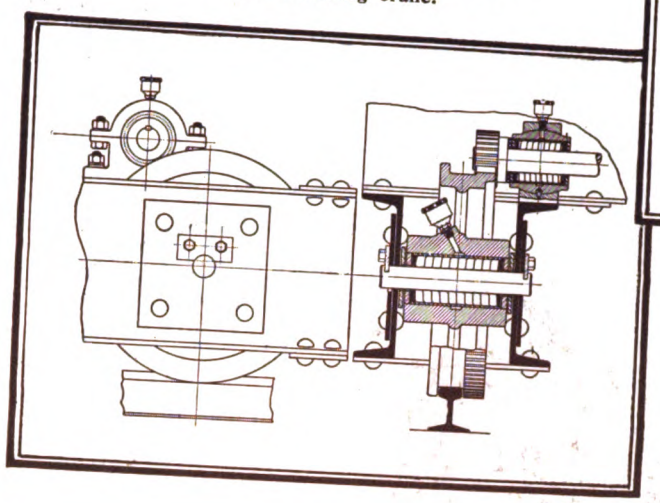


Fig. 17. Showing method of application of roller bearings to the bridge wheel of a traveling crane.

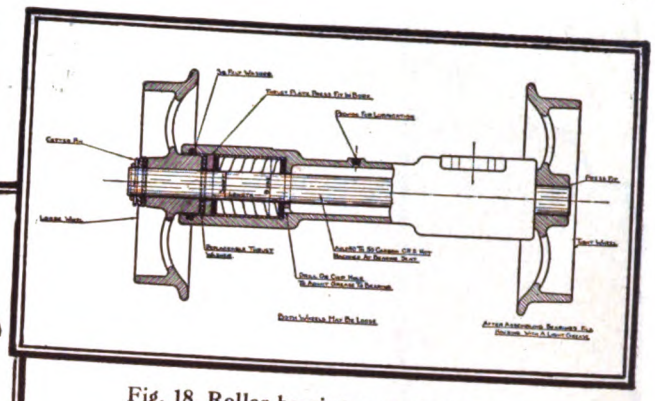


Fig. 18. Roller bearing mounting for mine car bearings.

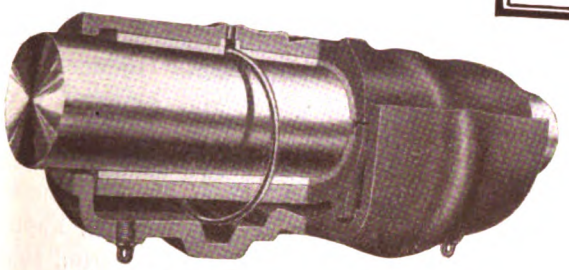


Fig. 19. Details of a ring-oiled bearing showing relation of ring to journal.

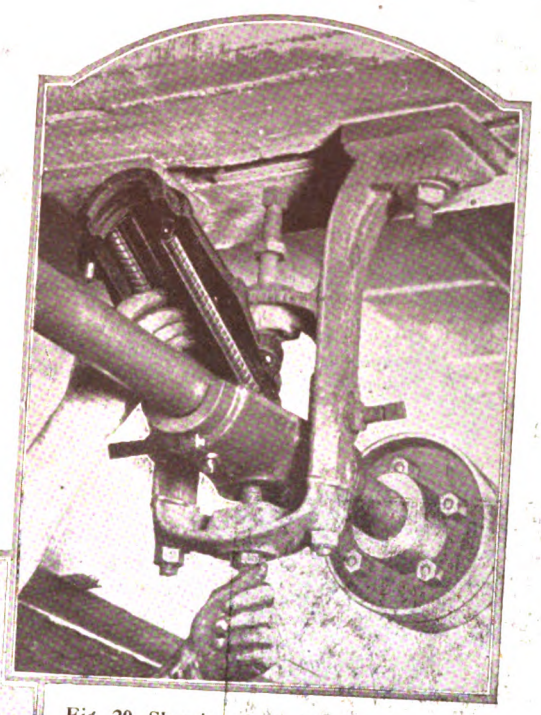


Fig. 20. Showing the method of removing half of a roller bearing from a line shaft support.

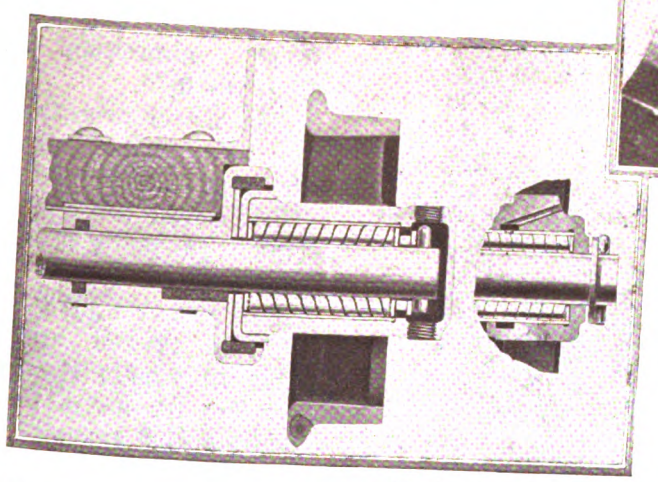


Fig. 21. Sectional view of a roller bearing showing details of design.

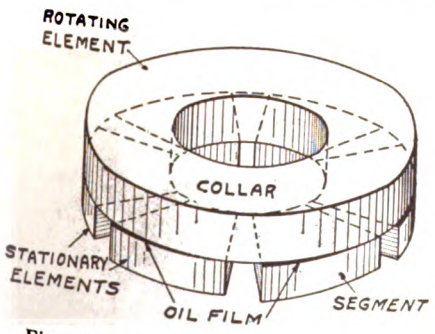


Fig. 22. Details of a well-known make of thrust bearing.

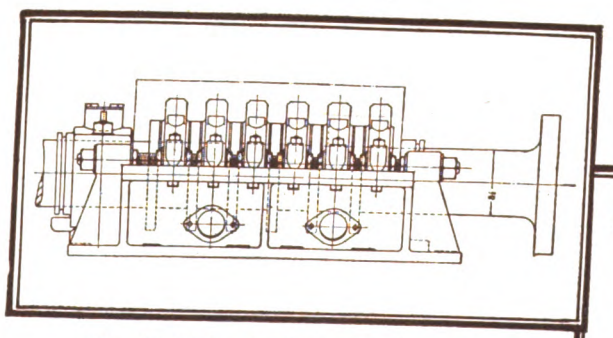


Fig. 23. Side elevation of a horse-shoe type thrust bearing.

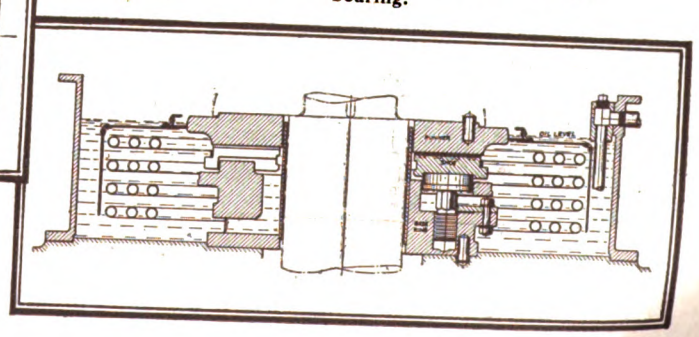


Fig. 24. Water cooled type of vertical thrust bearing.

tween any two bearing or rubbing surfaces which are in motion with respect to each other.

Where layers or particles of a fluid in motion in a bearing encounter irregularities in the metallic surfaces, the former are lifted over any projections by virtue of the pressure exerted by adjacent particles of the fluid which constantly endeavor to occupy the entire clearance space. In other words, fluid friction is independent of bearing pressures, hence the component coefficient of friction due to pressure is eliminated.

The extent and thickness of the lubricating film is usually a variable, which will be governed by (1) The rubbing speed; (2) The viscosity of the lubricant; (3) The load which is to be carried by the moving element or shaft; (4) The shape and degree of smoothness of the bearing surfaces; (5) The area of the bearing surface and (6) The provisions that are made for distribution of the lubricant, such as the oil grooves, or the chamfering or beveling of the edges of the bearing metal.

Having reviewed bearing surfaces, it is now well to discuss the various types of bearings we may encounter in the average industrial plant today. In general, a bearing is known as any surface or point of contact which is capable of serving as a support or guide for another surface which is subject to motion with respect to the first. Therefore,

(*Continued on page 72*)

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Electric Welding and

The Practical Achievements of a

By J. F.

THE old-time method of welding employed by the blacksmith has probably never been surpassed. The smith, by the use of borax or otherwise, cleans the surfaces and unites the metal by hammer blows resisted by the anvil. One great advantage consists in the fact that while the temperature required is high, it does not need to approach the melting point. A plastic condition is sufficient. The compression induced between anvil and hammer does the rest.

But there are serious limitations. First, the class of metals to which the system is applicable is very limited—iron, steel, nickel, and perhaps one or two other metals of a more or less unusual character. Even in the cases where the metal itself is to be rated as weldable, certain limitations may have to be imposed. Thus, iron is weldable and so is steel, but cast iron is not. Second, the difficulties inherent in making provisions for the necessary heat and the necessary compression operate to limit the field.

The newer processes of welding have wonderfully enlarged the opportunities of application. These newer processes are principally gas methods on one hand and electric on the other. The chief gases employed, in addition to oxygen, are hydrogen and acetylene. Such processes require usually a fusion of a considerable amount of metal in

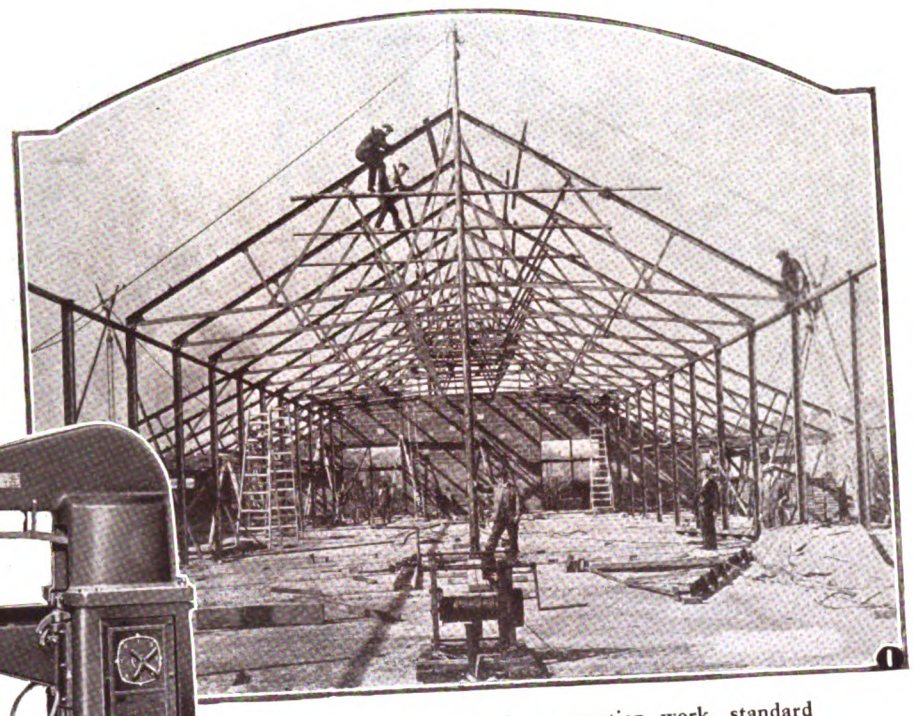
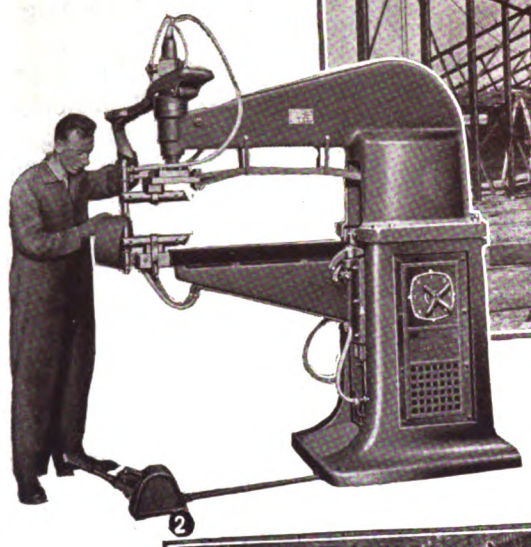


Fig. 1. In steel construction work, standard shapes may be cut and welded electrically at the point of erection, as in this English factory building.

Fig. 2. Below—A type of spot-welding machine which is adaptable to rather large work.



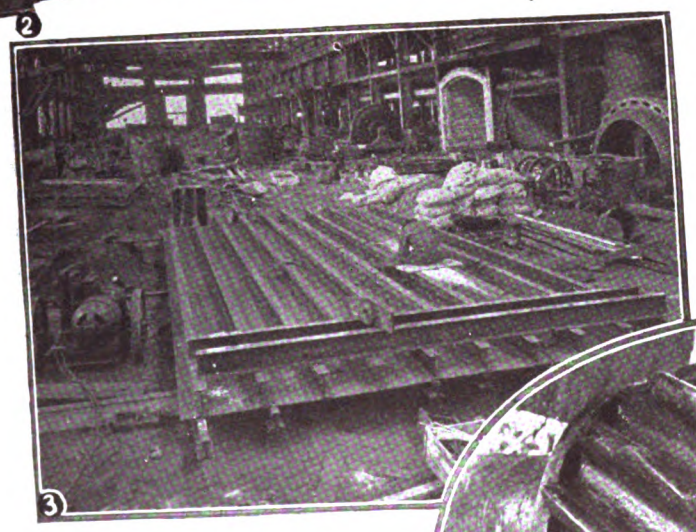
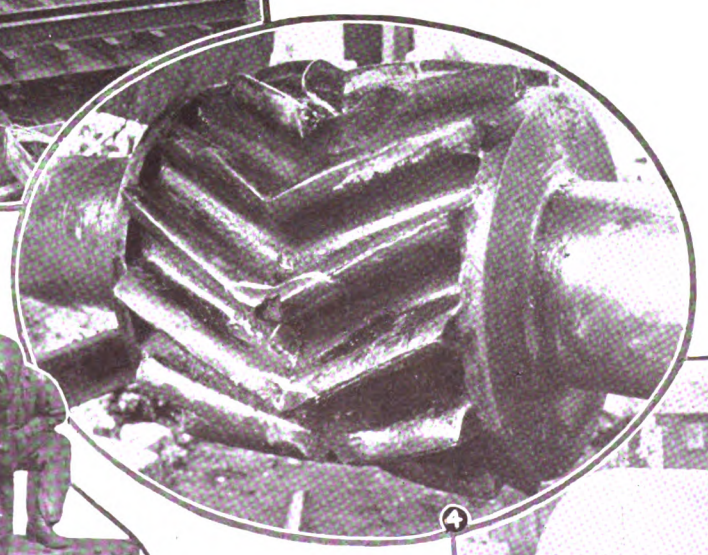


Fig. 3. At the left—This man is working on a large annealing cart, which is electrically welded throughout.

Fig. 4. Below—Showing how arc-welding can be used to repair broken teeth in a large steel pinion used in a steel mill roll drive.



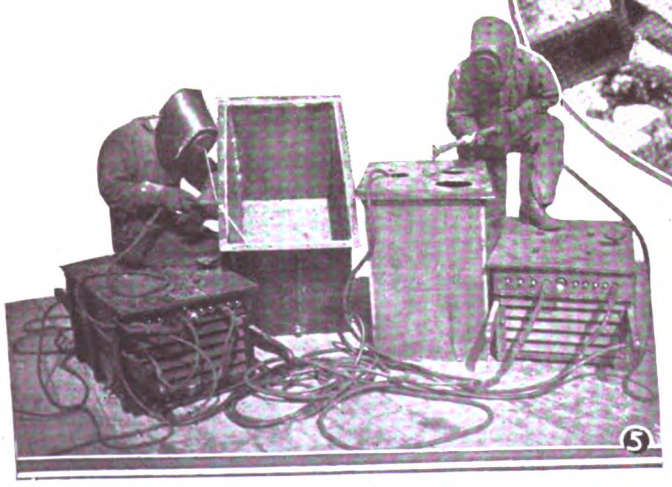
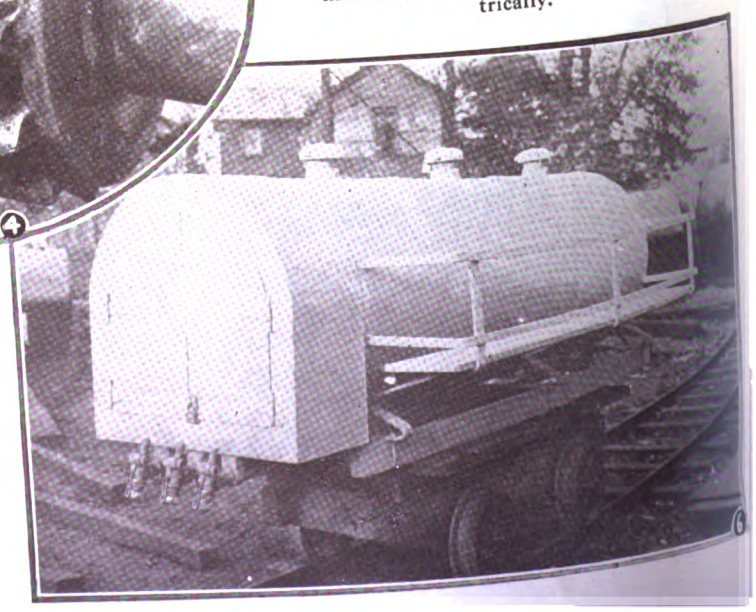


Fig. 5. Portable outfits for arc-welding and cutting.

Fig. 6. This big gasoline tank, for truck mounting, was welded throughout electrically.



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Its Applications

Young, but Growing Art

SPRINGER

the immediate region of the weld. There is, in this circumstance, an important feature distinguishing gas welding from anvil welding. However, the use of metal at the melting temperature carries with it a valuable advantage. Compression is not required. The molten material flows together. However, there is undoubtedly disadvantage in the excessively high temperature.

Now, electric welding includes within itself two principal processes which resemble, one of them, the older process used by the blacksmith, and the other of them the fusion method characterizing the gas procedures. That is to say, *arc welding* constitutes one of the two chief methods of using electricity. An arc is created and this arc is used to fuse metal and thus bring about the weld. Then, there is *resistance welding*. It is the second principal process by which electricity is employed. The surfaces to be welded together are brought into a more or less close contact. In the region of contact, however, the passage of an electric current is impeded by the existence of a break where conduction is imperfect. This region of imperfect conduction supplies *resistance* when a current is passed across it. The result is heat. If now we add compression to the heat, we have the elements necessary to anvil welding.

The use of the electric arc as

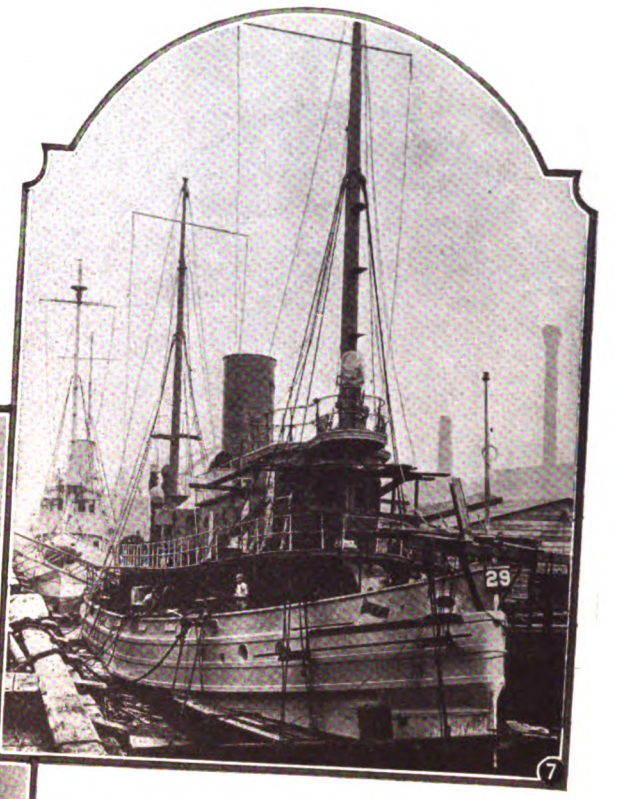


Fig. 7. At the right—Steel masts, such as are used on this Government boat, lend themselves to electric welding.

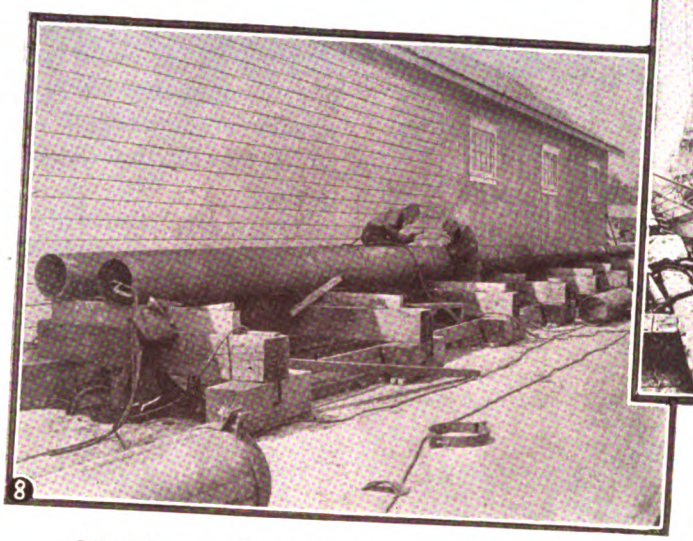


Fig. 8. Here is shown the operation of welding seams and joints on masts for Government boats.

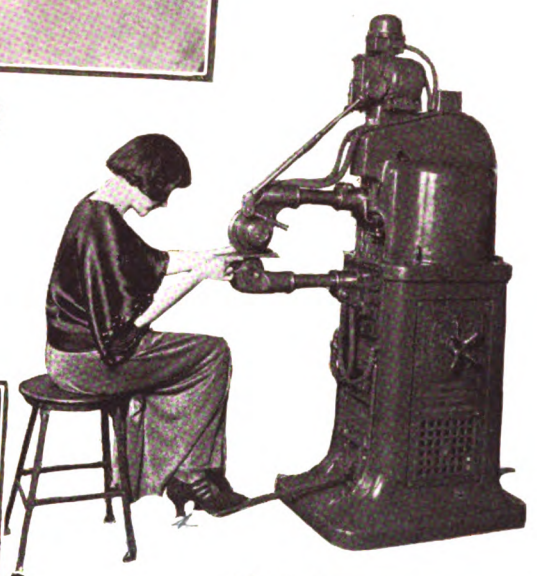
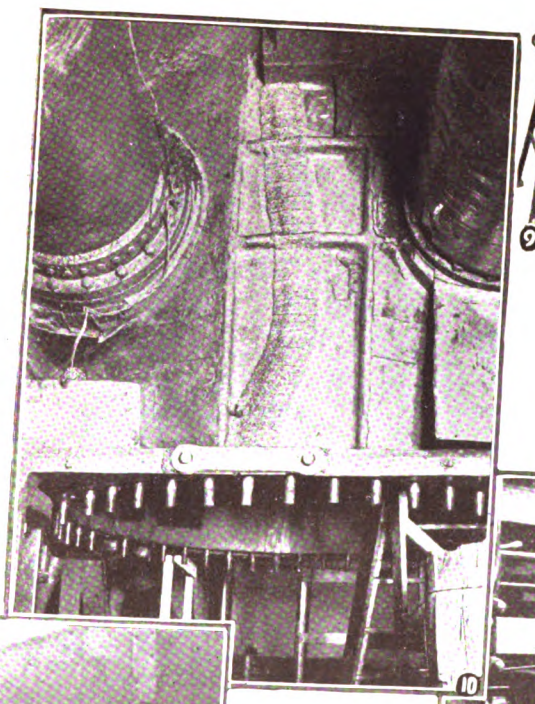


Fig. 9. A seam welding machine, for small work.

Fig. 10. At the left—An arc-welded cast iron cylinder of 80″ bore, 60″ stroke, cracked 5 feet on near side and 3 feet on far side, whose repair saved over eleven thousand dollars and more than seven months' time.



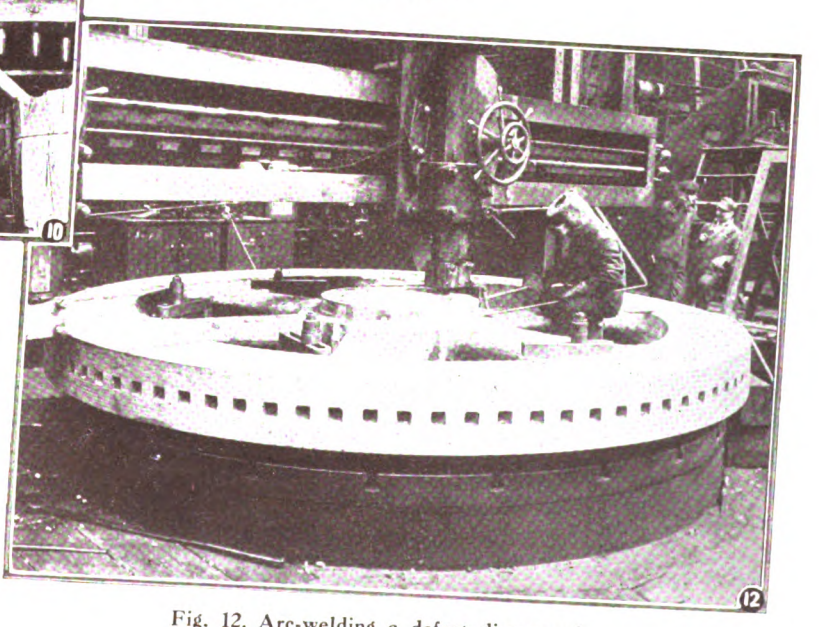
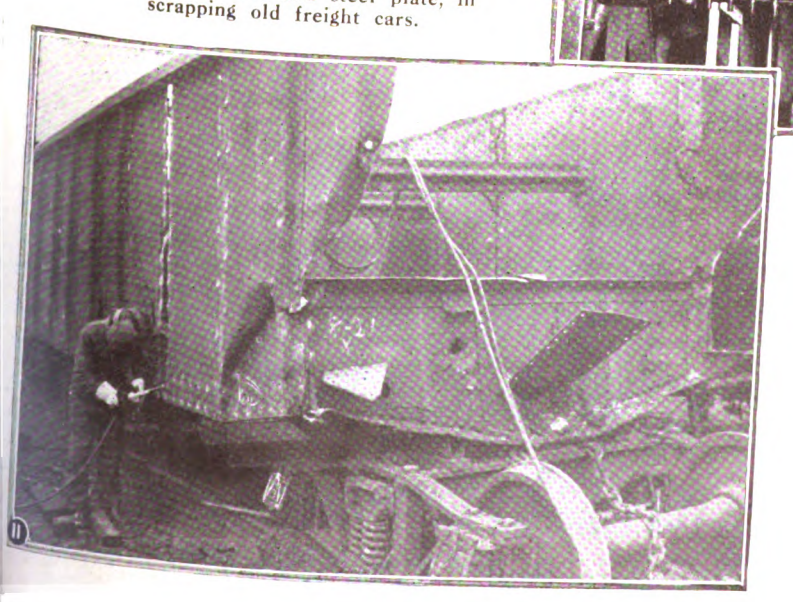


Fig. 12. Arc-welding a defect discovered when machining a large fly-wheel hub.

Fig. 11. Below—Using the electric arc for cutting rivets and steel plate, in scrapping old freight cars.



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Fig. 13. Fabricating structural iron parts with an arc-welding machine.

a means of uniting metals is said to be older than the resistance method. There is reason for believing that it was used as far back as 1881 in welding together parts of electric storage batteries. What was done appears to have been substantially this: The work was connected up with the positive pole of a source of current. The negative pole was connected to a carbon rod. Upon touching the rod to the work, and then withdrawing it a little an arc could be formed. There would thus be produced a considerable amount of heat which was utilized in uniting the parts.

There are several methods of employing the electric arc. One of these, which does not appear to have much practical importance, creates an arc by using two carbon rods, mechanically held to form a V. The arc may be directed to the points desired by means of a powerful electromagnet. A modification of this method has been devised which makes use of carbons containing a small relative amount of metallic oxide. In consequence, the arc may be increased in size and the work saved to some extent from excessive carbonization. It is understood, however, that not even in this modified form is the two-carbon process of a very practicable character.

There is another procedure which may conveniently be termed the one-carbon system. The carbon and the work are each connected to a pole of a source of current. It is sometimes considered preferable to connect up the carbon to the negative pole, as this provides against a stream of carbon particles flowing onto the work and thus carbonizing it.

Still another system of arc welding is known as the metallic-electrode process. Here the work constitutes one electrode, but the other is a metal rod and not a carbon one.

There is also a process which may perhaps be classed with the preceding. A metal rod constitutes one electrode, but the rod is covered or sheathed in a special way. Particular attention is directed to the fact that the process using a metal rod covered with a special sheath may be employed either with direct or alternating current. Certain electric arc welding processes require direct current, but this particular system is not thus limited to the one class of current.

Perhaps another electric process ought to be mentioned. It

(*Continued on page* 51)



Fig. 14. At the right—Anchoring rods to bridge plates, on an Oregon bridge, by electric welding.

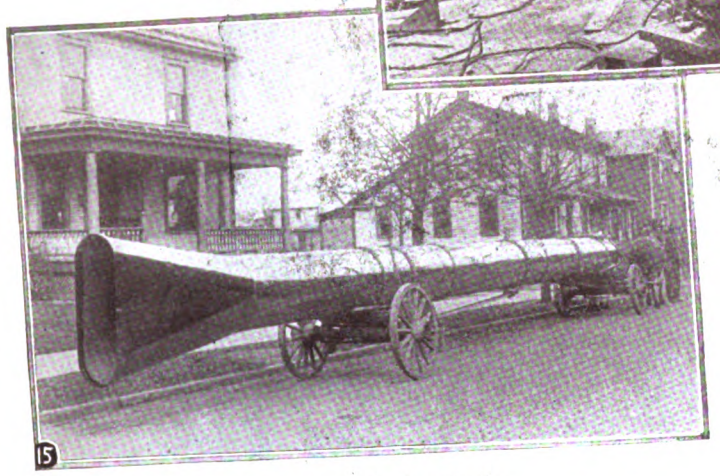


Fig. 15. A fifty-foot stack, electrically welded throughout.



Fig. 16. Welding the tank of a big 220,000-volt oil circuit breaker.



Fig. 17. Arc-welding misplaced rivet holes in structural work.

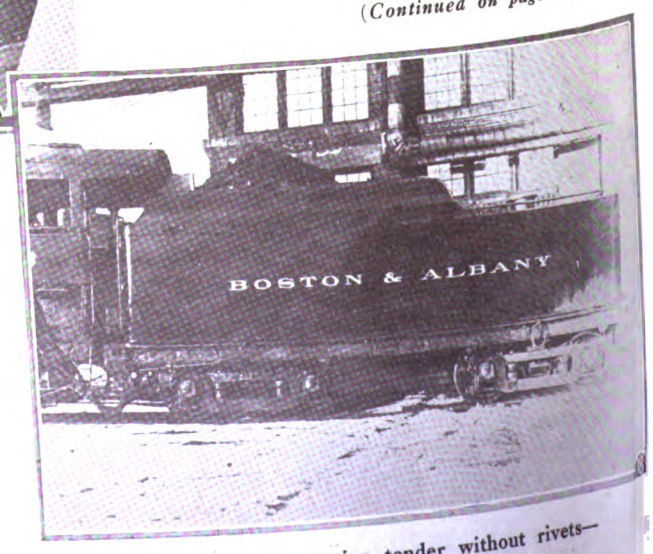


Fig. 18. A locomotive tender without rivets—electrically welded.

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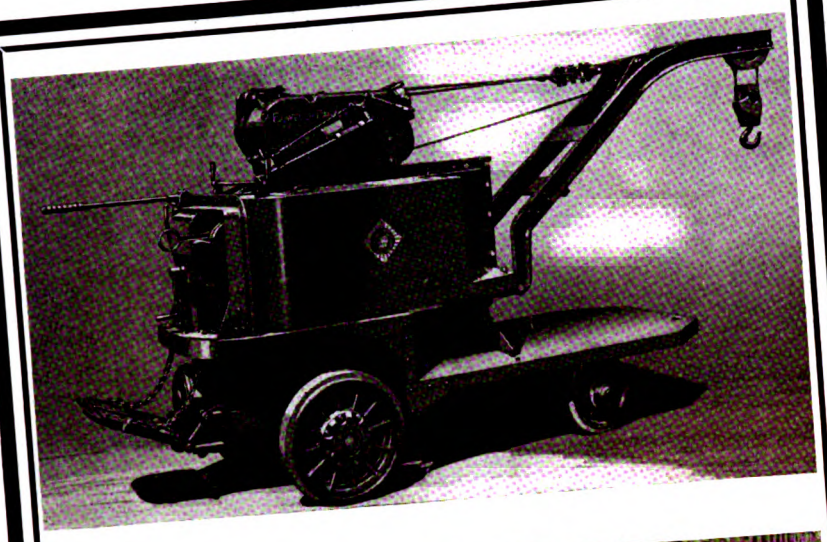
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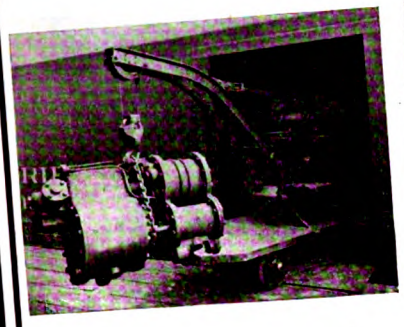
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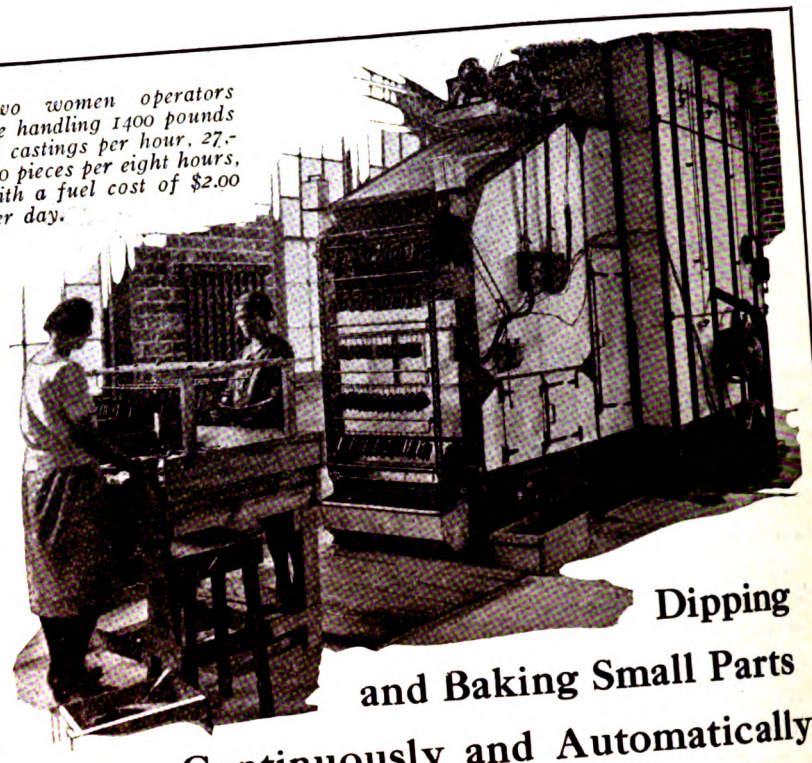
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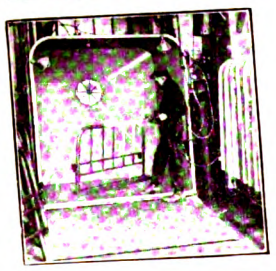
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Carpentry, Masonry, and Plant Maintenance

(*Continued from page* 12)

der should be examined often as they are a source of danger if they should break while a man is near the top. Wooden lockers are now nearly obsolete, the steel and expanded metal lockers having so many advantages that there is not much to be said against them. Steel lockers require little maintenance. With rough usage the doors may need straightening up so that they will close easily, and locks are frequently put out of order and need repairing. Where there is not enough room for single lockers the double tier lockers may be used. The men don't like these in the winter because they are not long enough to hold their heavy overcoats, so it is often better to put two men together in one large locker than to use the double tiered ones.

The doors between adjoining buildings or doors in fire-proof partitions between different rooms in a large building are very important from the standpoint of fire protection. They should be regularly inspected to see that they close properly and that the chains and fusible links are in good working order. Gravity sliding doors are often blocked open by employees to keep them from shutting, but this practice should not be allowed because the door would not shut in case of fire. With weights properly adjusted to balance the door it should move easily. Swinging fire doors are used at exits to stairways and these should always be kept in working condition so that they will close tight in case of fire, because the regular fireproof stair tower is apt to become filled with smoke. Both these types of doors are usually tin covered on heavy lumber doors, and to retain the underwriters' approval the tin covering must be preserved intact. Fire-proof elevator doors are of various types, possibly the most used kind being the vertical raising and lowering counter-balanced type. The lower half of this door forms a sill for trucks being pushed on and off the elevator. For very large doorways the rolling steel door is admirably adapted because of its ability to roll up into a small casing when not in use. These are hand or motor operated according to their size and unless they are bent or otherwise distorted they should require very little maintenance outside of painting. The newer types of combination folding and sliding doors are also used on large openings and the horizontal folding doors are also largely used. Doors leading to bridges or to outdoors are often in the path of continual trucking and some provision should be made for opening and closing these doors without the necessity of having the trucker stop to open and shut them. Double doors hung on double swinging spring hinges may be opened by pushing the truck into them and allowing them to close after it has passed. However, with electric trucks the doors must be heavy and be protected on both sides with thin sheet steel to stand this abuse. Doors in wooden partitions such as office partitions should be equipped with door checks so that they will close silently and

(*Continued on page* 33)



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The illustration above shows how hand labor has been replaced by suction apparatus to unload box cars of such material as dried blood, tankage, etc., used in the manufacture of fertilizer. The material is conveyed quickly and the air is entirely cleaned by its passage through the filters.

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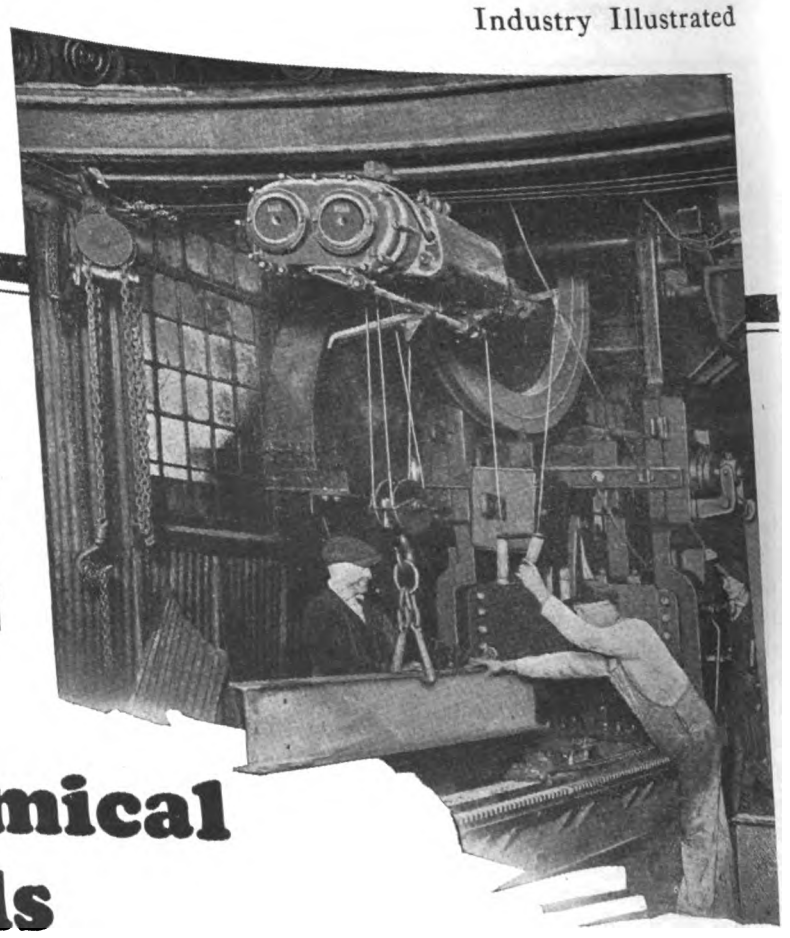
DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.

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Link-Belt's Two Leaders in the Economical Handling of Materials

The "Cub" Portable Loader—

Here is the lowest-first-cost and the lowest-operating-cost method of loading materials from the ground to wagons or trucks. Handles practically any loose materials—coal, sand, stone, gravel, fertilizer, foundry refuse and similar materials.

Hundreds in daily use throughout the country, testify to its merit. It is the most popular unit built by Link-Belt. The "Cub" can load material faster than half a dozen or more men. It knows no superior in design, construction or performance. It is a Link-Belt Guaranteed Product.

Ready to work when you get it—fully equipped. While we can furnish any type of motor to suit local conditions, our standard "Cub" Loader, selling at the new low price (without the special chute shown in the illustration), is equipped with—

2-H. P. two or three phase, 60 cycle motor, 21 ft. conveyor length, 18" wide belt assuring large capacity. Belt is guaranteed against cutting or fraying. Wide loading hopper at foot of conveyor is hinged—easily and quickly opened. So simple and sturdy anybody can run it. Loads 45 cubic feet of material per minute.

Price, $485 f. o. b. Philadelphia or Chicago. If you now load materials by hand, you are losing time and money.



Use This Coupon

LINK-BELT COMPANY
2045 Hunting Park Ave.
PHILADELPHIA, PA.

Please send me your book on
☐ Electric Hoists
☐ Portable Loaders

Name _____

Address _____

City _____ State _____

By _____ INDUSTRY ILLUSTRATED

The Link-Belt Electric Hoist—

Use your ceiling—instead of your overcrowded floor—to carry your materials from place to place—with the highly efficient Link-Belt Electric Hoist. Move a 50-lb., 1000-lb., or 2500-lb. load by the mere pull of a control. Lift, carry, deposit, at the will of the operator. So simple anyone can run it. Does the work of many men—and is popular with workers, because it makes hard lifting a simple, easy and pleasant task.

"Let George Do It"

Shopmen call the Link-Belt Electric Hoist by the fitting, descriptive name—George—because it does all the work that famous phrase implies.

If you lift and carry iron, steel, or machine parts or finished products—indoors or out—or handle your material to and from machines, or from one department to another—write for our catalog No. 480, and see how easily and economically it can be done with the Link-Belt Electric Hoist.

The Link-Belt Electric Hoist is made in many sizes. The illustration shows our standard 3-ton hoist, and illustrates but one of many varied applications.

Price, $300 f. o. b. Chicago or Philadelphia, for the 1000-lb. standard Link-Belt (C1½) Electric Hoist, a neat, compact, efficient machine that will show savings even in the small-size plants.

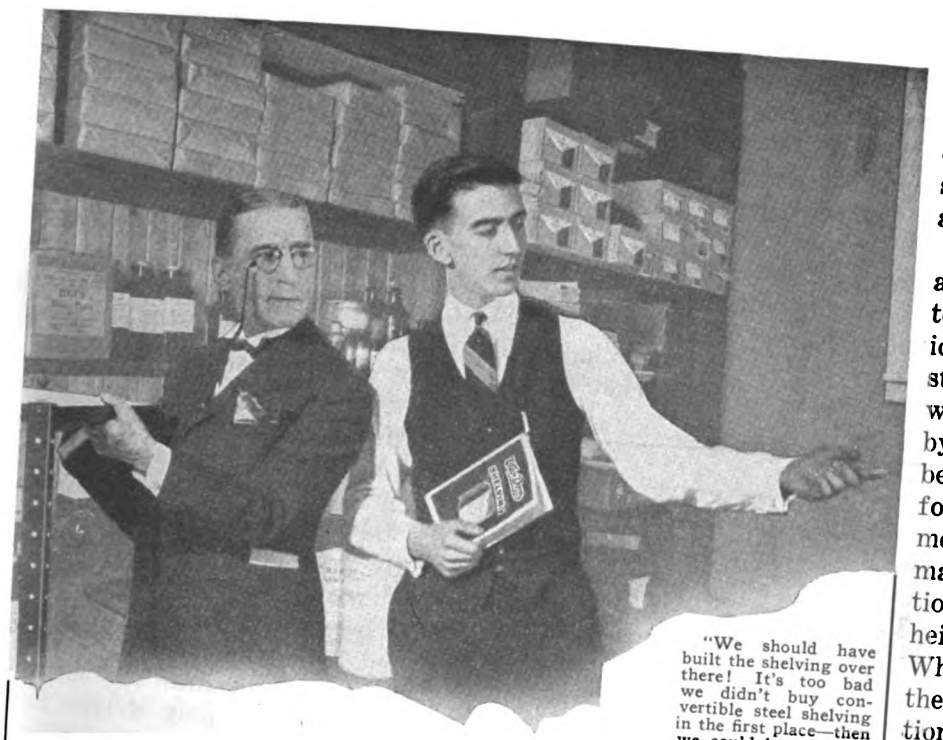
Send For These Books

They may point the way to overcoming bothersome handling problems. Write and tell us how you handle your materials, and let Link-Belt experienced engineers study your methods. They may suggest better methods of handling that will speed up your production. We make no charge for advice, layouts or estimates. Asking for Link-Belt catalogs entails no obligations.

LINK-BELT

Elevating and Conveying Machinery

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"We should have built the shelving over there! It's too bad we didn't buy convertible steel shelving in the first place—then we could have moved it as needed."

Don't Wish You Had Built The Shelving Elsewhere

Use Van Dorn Convertible Steel Shelving and Relocate it Whenever Required.

No man living can look far enough into the future to know what shelving is going to be permanently required. Your needs grow! And change! And shift from place to place!

Modern practice is to install Van Dorn Convertible Steel Shelving, built up from standard units wherever required. Whole banks can be moved. Sections taken out or added. All torn down and reassembled. Built around doors and windows or under stairs. Any type of shelves, closets, etc. Closed or open. For light or heavy burdens. Plain or with attractive trim.

Inexperienced office help can do it, and the only tools required are a screwdriver and wrench. Don't use built-in shelving. Send for catalog of Van Dorn Convertible Steel Shelving.

THE VAN DORN IRON WORKS COMPANY

Mastercraftsmanship-in-Steel

CLEVELAND

BRANCHES:

leveland New York Chicago Philadelphia Washington Pittsburgh

Van Dorn

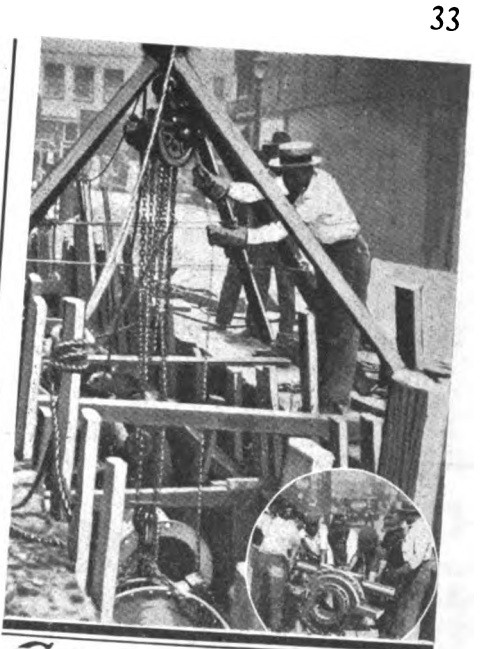
MASTER-CRAFTSMANSHIP IN STEEL

(*Continued from page* 31)

not disturb anyone. Door checks should be adjusted to the size and weight of the door they are to close.

Shop partitions should be adapted to the service they have to give. For average shop service, where a cheap and fairly strong partition is desired, the wooden partition made of a two-by-four-inch framework with beaded sheathing to a height of forty-two inches and expanded metal or wire netting above, makes a good, serviceable partition. It is usually run to a height of seven or eight feet. When glazed sash is used above the beaded sheathing this partition may be used for shop offices. Both of these types of wooden partition have the disadvantage of having to be built in place for the particular job and if they have to be moved the breakage caused by ripping is very large. Steel partitions of all kinds have the very great advantage that they can be set up and taken down as often as necessary without loss. For shop partitions, solid steel to a height of about forty-two inches with expanded metal above, is the usual choice, although some prefer all expanded metal on a steel frame. Expanded metal resists blows from trucks or other objects extremely well and for this reason is largely used in preference to wire netting. For shop offices steel partitions with solid panels below and glazed panels above make an excellent combination. In large rooms where only a little heat is required a small office partitioned off in this way may be heated to the temperature desired without the expense of heating any other part of the room or building. There is on the market a wooden partition with glass upper portion and with top section telescoping so that it can be moved and adjusted to various ceiling heights. This is built in panels similar to steel partitions and is principally used for office partitions where there is a probability of moving them to accommodate changes.

Steel sash are subjected to rough usage due to the men slamming them shut. The hardware and catches on the swinging sash should be in good working order so that the catch will snap and hold the sash tight without slamming it two or three times. This is also apt to warp the sash and they will not be weather tight in storms. The



CYCLONE HOISTS
HIGH SPEED

We saw this Exampel of Labor Saving From Our Office Window!

IT took nine husky men, with many a "yo" and a heave, to place this ponderous fitting in position for lowering into a trench dug by the Cleveland Electric Illuminating Co. for laying the steam pipes to the new Union Trust Building, Cleveland.

When hooked to the Cyclone Hoists, rigged over the trench, one man alone lowered the same heavy weight into position!

One never need go far to find places where a Cyclone Hoist can save labor and cut costs. Perhaps *you* need only look out *your* window into your factory yard, your shop or warehouse to see instances where a Cyclone Hoist can profitably replace muscle-methods. Look!

Send for catalog covering 1 to 40 Ton Hoists Cranes, Trolleys and Overhead Track Systems

DISTRIBUTORS EVERYWHERE

The Chisholm-Moore Mfg. Co.

Cleveland, O.

Hoists Cranes Trolleys

Overhead Track Systems

Branches: New York Chicago Pittsburgh.

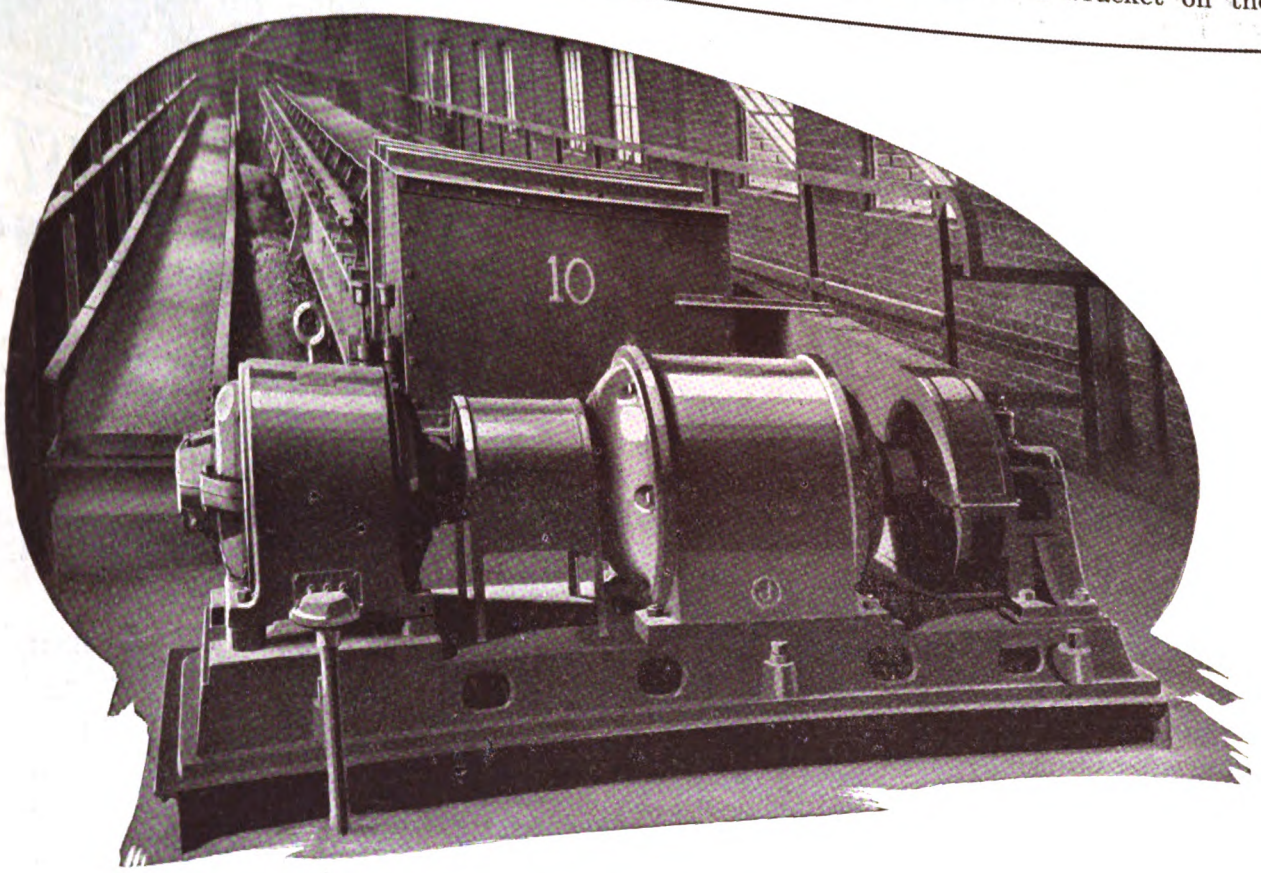
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keep water or snow slush from leaking in. The savings in coal by taking care of these items will more than repay the cost. Ventilation is necessary but it should be under control. Air leaks around windows on a cold windy day often make it impossible to heat the side of the building facing the wind. In office buildings or other buildings with wooden sash a metal weather strip should be used all around. This effectually takes care of air leakage and keeps windows from rattling. For upper steel sash the chains for holding the swinging portions open should be arranged so that any degree of opening desired may be had. Some chains fit into slots in a bracket on the lower sash, or rings may be fastened to the chain, so that any opening may be had by hooking the ring on an inverted hook. Monitor sash or other high sash are best controlled by sash operating devices having a rod or shaft controlling a row of sash. The method of rotating this shaft from the floor may be by chains or shafts connected by bevel gears.

The front board on benches will need to be replaced quite often where rough work is done on the benches and this can easily be done if the benches are built with pressed steel or cast iron legs to which the board is bolted. The bolt heads should be countersunk into the board and a wooden plug driven in above the bolt head after it is tightened up so that the top surface will be smooth and will not scratch any work. An economical way of building benches is to use a heavy maple or other hardwood plank on the front of the bench only and fill in the back of the bench with seven-eighths inch tongued and grooved flooring laid in short lengths at right angles to the front board. Usually the heavy work is done on the front of the bench and a heavy plank on the back half of the bench is an unnecessary expense.

Industrial track should be kept lined up to make for economical hauling, and switches and crossovers should be kept in good condition so that cars will not get off the track. The running gear on the cars will often be damaged or the frame bent and this should be taken care of by the machine repair department. Car bodies and decks should be repaired or replaced when worn or broken so that no work will fall off or become damaged. The rail and switches on overhead monorail systems should be kept in working order, the switches are especially important.

On swinging sash, shades on rollers are hard to handle unless each sash has its shade fastened to it and arrangements are made for fastening the shade at the bottom of the sash to keep the wind from whipping the shade when the sash is swung open. To overcome this trouble with shades sometimes a curtain is made of white canvas or heavy muslin and hung on rings on a pipe above the window. This pipe should be bent out from the wall so that the curtains will hang almost straight when the



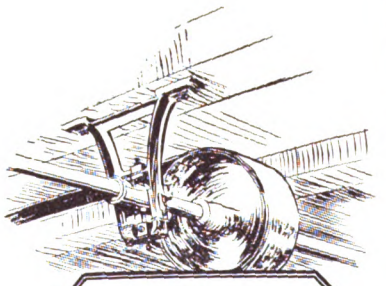
Reduces Electric Motor Speed in a Simple, Efficient, Economical Way

Here is shown a Jones Speed Reducer—identified by the circle J trade mark—driving a Coke Breeze Conveyor in a Water Gas Plant. The electric motor speed is 860 R.P.M. The final speed is 24.1 R.P.M.—a reduction ratio of 35.64 to 1.

This compact, complete reduction unit eliminates belts, shafts, pulleys or exposed gears. Gives greater power efficiency. Prevents accidents. Cuts depreciation and upkeep expense. Saves space.

After installation, the Jones Speed Reducer needs no attention other than occasional oiling. An enclosed unit, running in an oil bath, it operates perfectly under all atmospheric conditions.

We have just published a book on the subject of power transmission and speed reduction. It will interest you, for it contains much valuable information and is well illustrated with photographs of actual installations. A request will bring you a copy by return mail.



Power Transmission Service

IN addition to spur and worm gear speed reducers, we manufacture a complete line of power transmission appliances—hangers, pulleys, couplings, pillow blocks, friction clutches, ball-bearing loose pulleys, safety collars, etc.

The service of our engineers is at your command. Their experience may prove very helpful. We will be glad to have you write us.

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W. A. JONES FOUNDRY & MACHINE COMPANY
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Jones Speed Reducers

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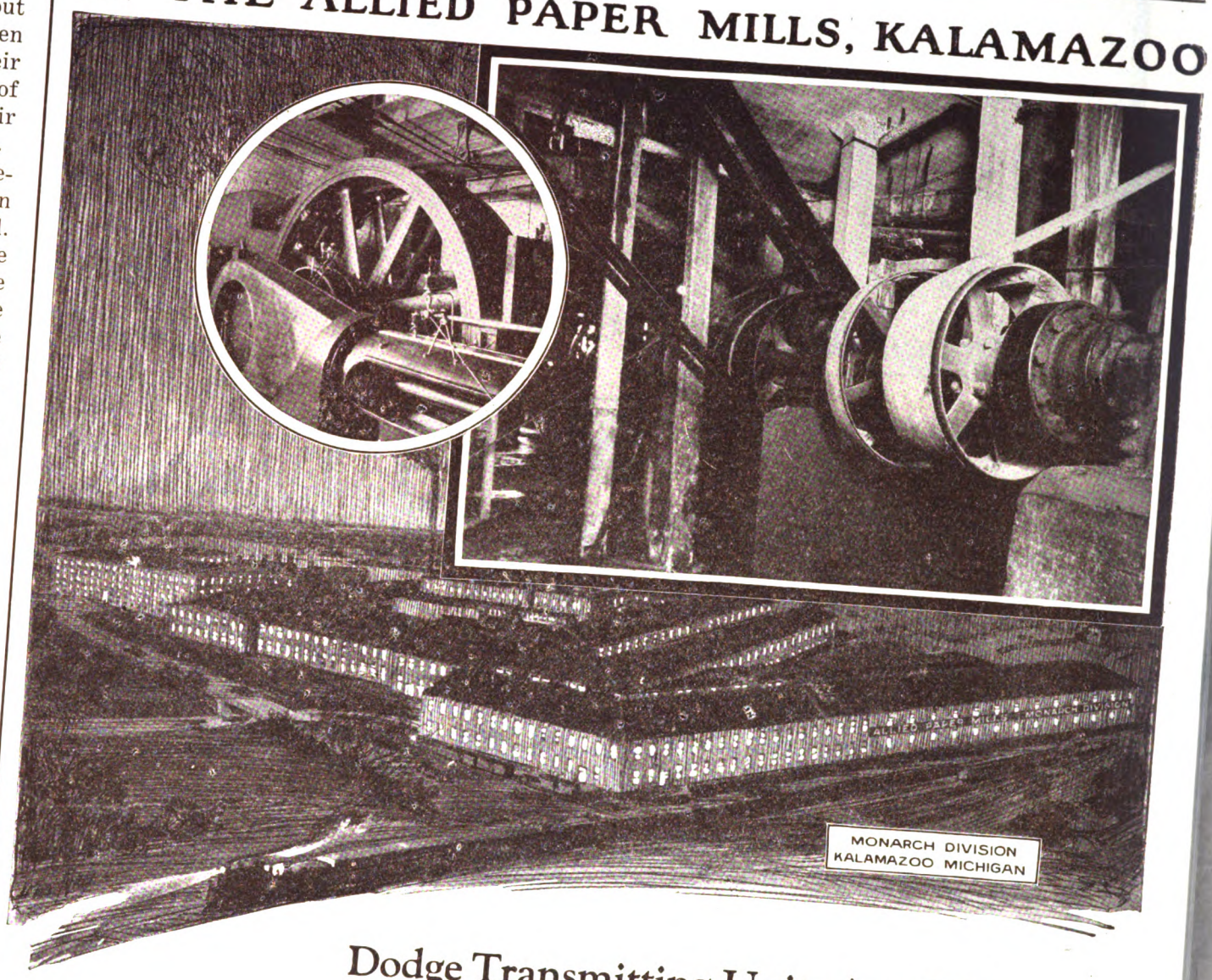
swing sash are open. With twenty-foot windows a one-inch pipe supported in the middle is usually used. When not in use these curtains may be tied back at both sides of the window. Shades made of thin wooden slats that allow air to blow through but keep off the direct glare of the sun are used in many plants. These are used mostly in rooms exposed to full sunlight. Awnings may be used on small windows in office buildings and are often used on large windows of modern plants but the wind whips them and often breaks the fittings, making their use dangerous, due to danger of breaking the windows. Their use is usually limited to offices.

Picket and board fences require a great deal of care even if they are kept well painted. Posts of cedar last a long time but the upper part of the fence will usually outlive two or three untreated posts. Posts may be treated with creosote or some other preservative or they may be coated with hot tar on the part that is underground. One of the main points to be taken care of on fences is to build them so that water will not lodge anywhere. Posts should be beveled at the top and the end grain well painted. Wire fences supported on pipe or structural shape posts are coming into their own on account of their permanence and fine appearance. The posts are either driven into the ground and thoroughly braced or are set in concrete. This type of fence requires very little maintenance except painting. It is very hard to climb and as barbed wire may be stretched on inclined arms at the top it makes an excellent protection for a plant. Iron fences are also excellent fences but usually cost more than wire and are used for places where appearance is a factor. If kept well painted they will last for many years.

The cost of shipping the manufactured product can often be materially reduced by making a careful study of the conditions. When large quantities of the same piece are shipped day after day the weight of the container is important in order to keep down express and freight charges. The selection of the correct wood for the job is also important, as many light weight woods have as much or more strength than the heavier ones. On crates, the importance of proper bracing and the use of the three way corner are having their effect in the lessening of breakage in shipment. It is sometimes surprising how much the amount of lumber may be reduced in a crate and still be as strong as before. Box and crate making can be best done in a medium sized plant in the carpenter shop along with the other work, but in large shops it should be an individual unit. A very economical way to build boxes is to buy the box shooks in bundles and assemble the boxes in the shop. Where large quantities of boxes are required a complete box making department equipped with machines for cutting, grooving and glueing the boards is usual. Nailing machines are also necessary. It has been found that a box nailed together with cement coated nails will usually stand one and a half times as much handling as a box with ordinary nails. The carpenter shop should build the trays for machined parts. These trays should be made to fit the piece after the first cut is taken on it and be so made that the work

(*Continued on page 37*)

IN THE ALLIED PAPER MILLS, KALAMAZOO



Dodge Transmitting Units Are Giving 24-Hour Service

Alex G. Gilman, Pres. Allied Paper Mills, says:

"Dependable power transmitting machinery is as necessary to the manufacture of paper as is dependable paper to the production of fine printed works. Power costs always have been an item for the careful consideration of the mill executives, and in this period of high material and labor costs and the necessity for maximum production, we must watch every leak, be it power or material. We develop around 9,000 horse power, operate 24 hours six days a week, and trouble in our engine rooms or on our power line would stand us heavy losses."

In the Monarch Division of the Allied Paper Mills at Kalamazoo, Michigan, Dodge pulleys, hangers, bearings and clutches, and rope drive have been rendering 24 hour service, six days a week for 14 years.

Throughout the extensive operating departments of the Allied Mills, Dodge equipment is giving the type of continuous service the business of paper making demands. Dodge means power savings. Plants standardizing on Dodge rank on the plus side of the ledger in power actually delivered to production.

Five hundred local dealers distribute Dodge products on the immediate delivery basis. Trained engineers are always available for expert counsel on the special machinery demands of industry.

DODGE MANUFACTURING CORPORATION
General Offices: Mishawaka, Ind.
Factories: Mishawaka, Ind., and Oneida, N. Y.

DODGE

EVERYTHING FOR THE MECHANICAL TRANSMISSION OF Power

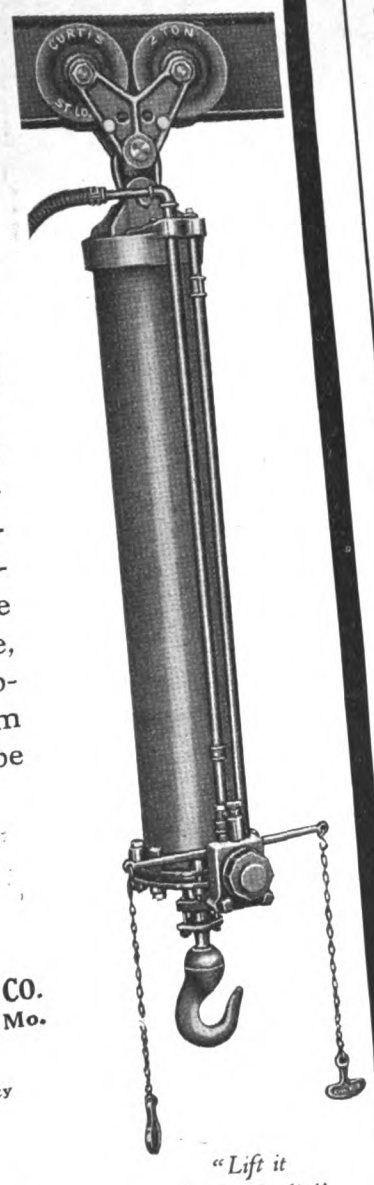
Branches: New York, Philadelphia, Pittsburgh, Boston, Cincinnati, Newark, Chicago, Atlanta, Minneapolis, St. Louis, Houston, Seattle, San Francisco

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Do You Lose Money *Between* Machining Operations?

EVEN if your plant is equipped with the most modern production machinery, there is still a big chance for you to lose money ***between*** machining operations!....Why? Simply because you may not be ***moving*** your material with dispatch, or economy (i. e. low labor cost).



Curtis All-steel ***Air*** Hoists and Roller-bearing Trolleys lift and move any kind of material, quickly, economically and safely, making use of a power already available in most plants. They save time and energy and men—before, during, and after machining operations. With Curtis I-Beam Trolleys a 4000-lb. load can be moved by a 50-lb. pull.

Capacities up to 20000 lbs. and various types to meet your particular needs. Send for full information.

CURTIS PNEUMATIC MACHINERY CO.
1668 Kienlen Ave. St. Louis, Mo.

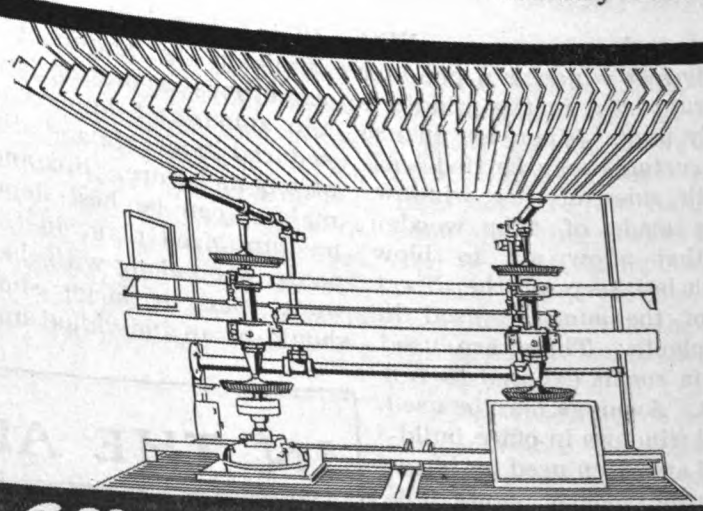
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"Lift it With Air"

CURTIS
AIR COMPRESSORS-HOISTS-TROLLEYS-CRANES
ST. LOUIS

CURTIS

311



A Non-Clogging Air Washer with Tandem Atomizer.

The illustration above shows top view of the atomizer chamber of a

Bayley Turbo Air Washer

The four motor operated sprayer discs create a very dense double spray of infinitesimal particles of water through which air must pass before it enters the room. In this passage through the screen solids, dust, soot and other impurities are removed from the air, leaving it pure and sweet as after shower breezes.

As a conditioning unit it will keep temperature and humidity uniform throughout the year, regardless of weather conditions. Unique construction of the atomizers keep the water spray uniform in density and clogging is entirely eliminated.

Especially designed for churches, schools, theatres, food producing establishments, hotels, public and office buildings.

Write for Booklet

Bayley Mfg. Company, (Dept. P) Milwaukee, Wisconsin



Let Us Do Your STAMPING

Use Your Own Labor and Equipment on More Important Work

INCREASE production, lower costs and do a much larger volume by such an arrangement.

Fifteen acres of modern mechanical equipment and 1200 workmen, trained for this special work, enables us to produce Stampings and Pressed Metal Parts at minimum cost.

Our estimate will prove that we can furnish any design, any metal, cheaper than you can produce them in your own plant.

42 years of experience is a guarantee of highest grade workmanship and On-Time deliveries.

G.P.&F. SERVICE
"KNOWING HOW SINCE '81"

Send Samples or Blue Prints

for estimate on any quantity of Stampings or Pressed Metal Parts in Aluminum, Steel, Brass, Copper, Tinplate or Sheet Zinc. We also submit estimates on Gas and Electric Welding, Tinning, Galvanizing, Japanning and Porcelain enameling.

Consider These Advantages

Many manufacturers who used castings, forgings and wooden parts have changed to Stampings and Pressed Metal Parts because the latter are cheaper, lighter, less cumbersome and stronger.

They are delivered ready for assembling without time and labor spent for machining and fitting.

Geuder, Paeschke & Frey Co.

1457-1750 Canal Street
Milwaukee, Wis.

352-358 W. Ohio Street
Chicago, Ill.

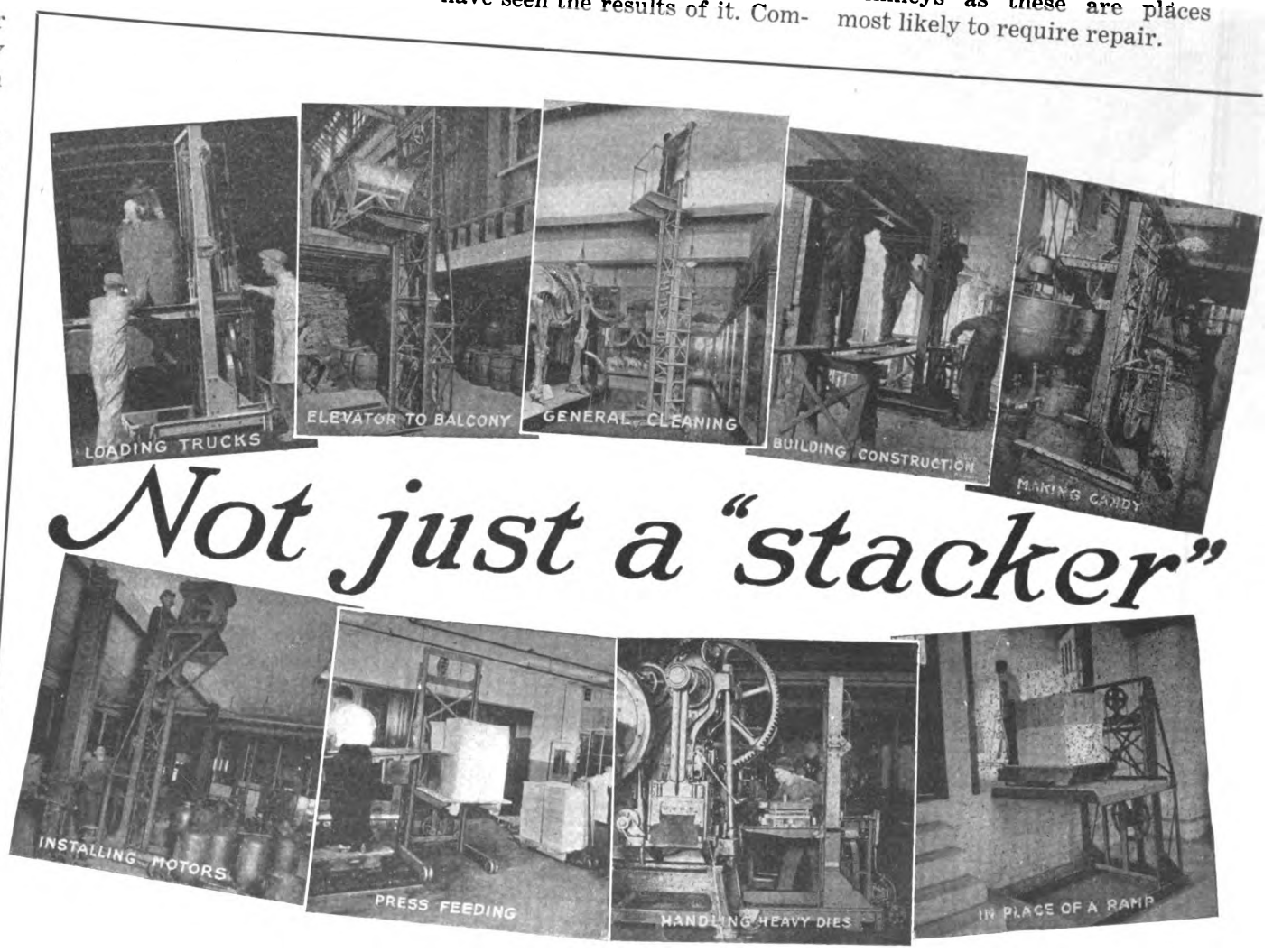
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(*Continued from page* 35)

cannot slide around and have corners bent over while the tray is being moved from one machine to the other for the next operation. The work may be easily inspected with trays and the number of pieces can be easily counted. In plants where some of the product is shipped in oak or mahogany boxes a cabinet making group of men is necessary on account of the finer work. These boxes are usually nicely finished and fitted with nickeled trimmings.

Truck platforms for lifting trucks must be sturdily made to last under severe service. The decks should be of heavy plank and the boltheads should be countersunk so the deck will be smooth. Wooden side supports do not stand up well so metal legs and angle iron supports are being used more and more. To stiffen this construction the bolts holding the legs should go through the angle iron. Special shaped bodies or racks on trucks or platforms are necessary to handle odd shaped pieces economically. Iron or steel wheels on heavy trucks soon wear ruts in the floors and these ruts allow trucks to drop suddenly on one side often throwing material to the floor. Rubber or cushion tired wheels and casters on trucks save wear on floors, and are therefore a good investment. On electric trucks these tires are a necessity to lessen the shocks to the truck when it hits unevenness in runways or floors. The quietness of tires is also a distinct advantage when trucks have to travel through assembling rooms. Trucks or cars with racks on them for use in japanning ovens are usually of all steel construction to stand the heat, and they must be frequently oiled in their bearings as it soon dries up.

The mason work in a plant is often handled by the carpenter foreman especially if he is one of the all around builder type. This work is largely confined to repairs and replacements on floors and walks, together with interiors and exteriors of walls. The corners of the walls at either side of doorways through which trucks pass are apt to become broken off by trucks hitting them, and it is well to protect them with a steel angle iron set into the wall from the floor up to a height of about four feet. In patching up holes in concrete floors or walks a wash of neat cement should be used so the new concrete will stick to the old. Walks and truckways and ramps or inclines in the plant should have easy grades for economical trucking. All railroads have what they call a ruling grade, which is the steepest grade allowed on the system. Likewise a plant should adopt a ruling grade so that a truck can be loaded to capacity and get to its destination with the load. If lift trucks are used there should not be any abrupt changes in grade as they may cause the load to drop if the change is very abrupt. Walks between buildings should be well drained so that frost will not heave them. Few of us realize the tremendous force of frost until we have seen the results of it. Composition floors are often laid over old worn floors and troweled smooth, making a rather inexpensive method of renewing floors. The masons' work includes pointing up exterior brickwork and in this work special attention should be given to cornices, parapet walls and chimneys as these are places most likely to require repair.



Not just a "stacker"

The Economy Portable Elevator is Ready for *Any* Job of Lifting

DON'T think of Economy Portable Elevators as just "stackers." They will not be limited by this nick-name to the one job of piling.

It is true, they are stackers, and good ones, too. But the hundreds of different kinds of lifting jobs that are being done by these machines earn them the right to be thought of and called by a more descriptive word. They are lifters, not stackers.

Look at the pictures above. There isn't a stacking job in the lot, but every machine is doing its special lifting work in a highly efficient and satisfactory manner and at less cost than possible with any other type of equipment. The buyers of these installations thought of these machines as what they are: lifters, and profited by the thought.

Therefore, we say again, let's get away from the idea that Economy Portable Elevators are merely stackers; let's think of them as lifters and see how their legitimate field of usefulness broadens at once.

Economy Engineering Company

2663 West Van Buren Street, Chicago, Ill.

We have a representative near you.

New York Office: 342 Madison Ave.

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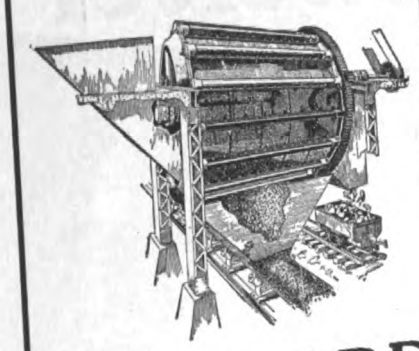


HAMMER CRUSHERS

39 Sizes

For Coal, Lime, Limestone, Shale, etc.

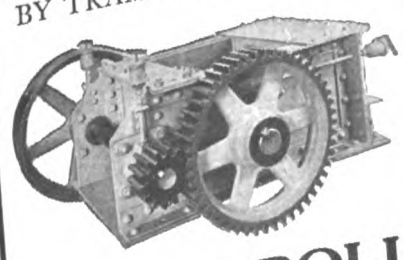
(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
(c) Oversize Bearings
(d) Patented Tramp Iron Separator
(e) Manganese Steel Wear Parts



BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY

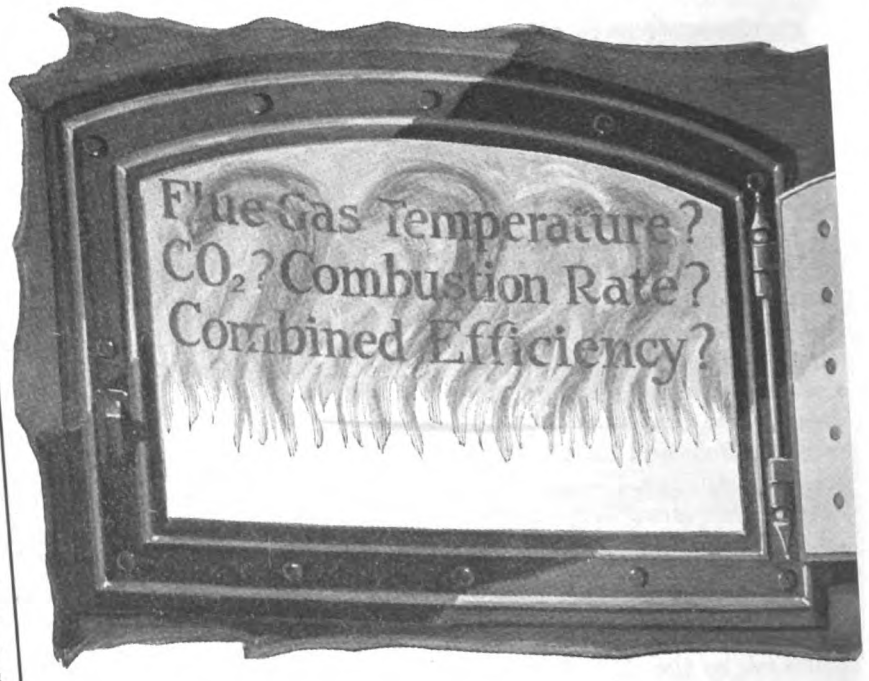
Stephen Girard Bldg., Philadelphia.
New York Pittsburgh Chicago

Machine foundations under large and heavy machines have an important influence on their operation. Reinforced concrete often allows the use of a smaller volume of concrete than if plain concrete was used. To get sufficient area without much depth a grillage of steel beams is often used. For special jobs like drop hammers a concrete sub footing with heavy hardwood timbers on end is usually used. As these timbers do not last many years at their best, only high grade lumber should be used and the timbers carefully bolted together. In plant work the average plastering is given a troweled sand finish as this compares in smoothness with rubbed down concrete and when painted two coats is smooth. In toilet rooms the lower sections of the walls are often of glazed tile with hard white plaster above. Floors are usually of tile of either small or large blocks. Repairs on tile are rather hard to make as it is necessary to carefully chip out the worn sections and fit in the new. Slate and marble have been largely used as partitions in toilet rooms but in factories the use of metal partitions is gradually becoming universal.

An efficient machine repair department is a necessary part of the maintenance work in any plant. A method of doing regular repairs at stated intervals to keep the machines in good condition at all times is insurance against breakdowns at critical times. With this system each machine is carefully recorded on a card giving the cost, rate of depreciation and present value, and having spaces for labor and material expended on repairs since its purchase. When a repair is made the cost is entered and an estimate is made of the probable future date when repairs should be necessary. This date is carried in a tickler file and when it comes around the machine repair department foreman should inspect the machine to see if repairs are necessary. If so a work order should be entered.

On large machines it is necessary to bring whatever tools are necessary to the machine and repair it on the job but on small machines that require a thorough overhauling it is best to send them to the machine repair shop. The machining of any special parts will have to be done in the shop and it is best to have the machine handy for

(*Continued on page 40*)



Your furnace as an expert sees it

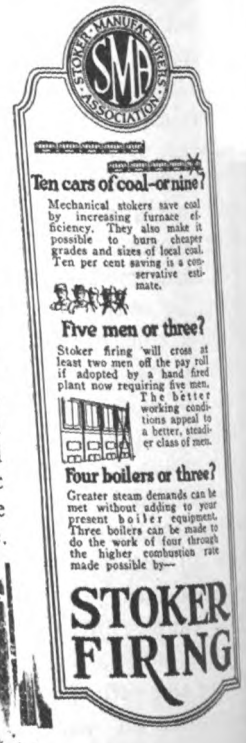
TO a combustion engineer the fire in your furnace is not simply a blinding blaze but a series of chemical reactions and controllable factors. He knows through chemical analysis exactly how much heat and steam each pound of your coal should produce. To him, sweating firemen and a general bedlam in the boiler room are not acceptable evidence that the maximum of heat is being given up by the coal.

On the contrary, the combustion engineer's test is an accurate calculation that takes into consideration temperature of feed water, coal analysis, steam pressure, quantities of water, coal, and the many other elements which enable him to establish furnace and boiler efficiency with scientific certainty.

Mechanical stokers have been developed by combustion engineers and are installed in your plant by combustion engineers on a basis of insuring better results. When you install mechanical stokers you get not only highly developed stoking machinery, but the best of engineering counsel as well.

It is this combination of service and equipment that makes fuel saving, labor reduction, and smokeless operation a foregone conclusion before the installation of mechanical stokers is even begun.

The part that engineering has played in mechanical stoker development is told in the free book, "Coal—The Basic Fuel." A card to the secretary of the association brings a copy to you—free.



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G. A. Sacchi, Secretary, Lester Branch, Philadelphia

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Have the satisfaction of buying your photo record paper and chemicals direct from the pioneer manufacturers.

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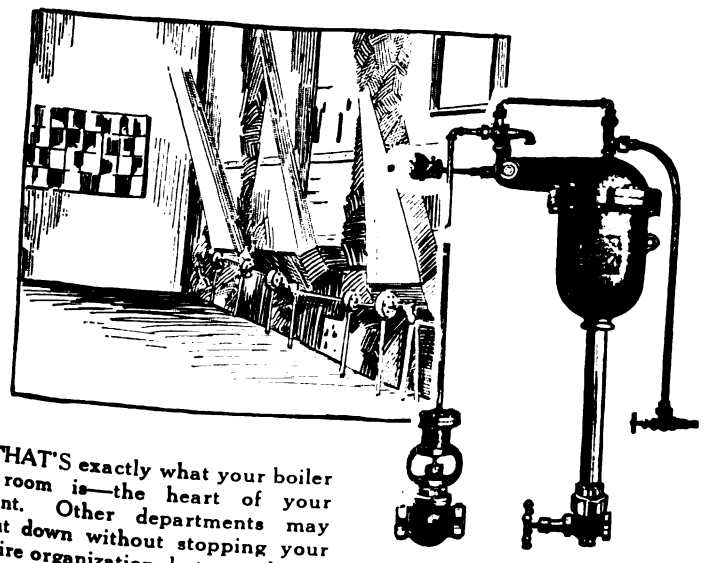
Rectigraph Company

(An Independent Corporation)

Originators of the Photo-Copy Machine

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THAT'S exactly what your boiler room is—the heart of your plant. Other departments may shut down without stopping your entire organization, but your boiler room must go on steadily if any wheel is to turn. Like the human heart, its proper functioning is of vital concern to every other part of the plant.

Vigilant Feed Water Regulators do their share—and more—toward maintaining the flow of production. They prevent boiler explosions; they automatically fix water levels; they conserve your costly fuel; they guarantee maximum operating efficiency. After 25 years of service, they are recognized as the best.

Our engineers will be glad to go over your boiler room and make money-saving suggestions—without obligation to you. Write us to-day.

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THE TEC UPLIFT



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The more interested you are in lowering your handling costs the greater will be your interest in the **TEC UPLIFT.**

Here is an elevating truck that has unloaded five cars of miscellaneous freight in 3¼ hours, distributing the materials an average of 300 feet. It will unload and load your freight cars and motor trucks, stock goods in your warehouses, and do faster, and at much lower cost the miscellaneous handling jobs, which now require so much costly hand labor.

And like all **TEC TRUCKS** no concrete roadways are needed. Any road is suitable for a **TEC.** That alone in a **TEC** means a great amount of money saved.

TECS ride over Belgian blocks, cinder filled paths, through snow, ice and sleet — up a 20% grade the load—in fact the toughest roads mean nothing to **TEC TRUCKS**

The **TEC UPLIFT** will raise the load from 5 inches above the floor to 8 feet 6 inches and there are no small pilot wheels to interfere in traverse and close stacking.

We'll be glad to go over your own conditions and give you specific information.

TERMINAL ENGINEERING CO., INC.

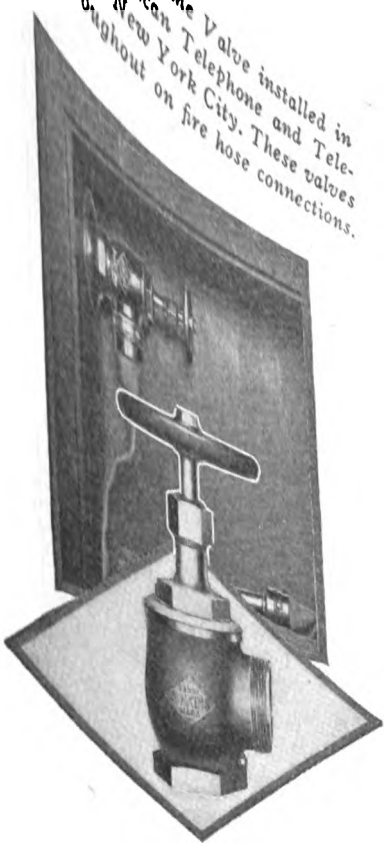
15 West 44th Street,

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District Engineers in Various Cities

TEC TRUCKS

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Jenkins Fire Line Valve installed in the new building of the American Telephone and Telegraph Co., New York City. These valves are used throughout on fire hose connections.

Fire!

Fire!

In the very important and responsible work of providing adequate fire prevention service, Jenkins Valves play a part in the new building of the American Telephone and Telegraph Co., 195 Broadway, New York, N. Y.

Jenkins Fire Line Valves hold without leakage the water pressures at every hose outlet. These valves are fitted with Jenkins Renewable Disc and do not stick or corrode at the seat, but give a free flow in the emergency.

Made of bronze, with large hand wheel enamelled red. Furnished plain or polished in natural bronze or nickel plate. Sizes 1½, 2, and 2½ inches.

There is true economy in using Jenkins Valves throughout—years and years of dependable usefulness prove this economy. Valves in types and sizes for all requirements.

JENKINS BROS.

80 White Street, New York, N. Y.
524 Atlantic Avenue, Boston, Mass.
133 N. Seventh St., Philadelphia, Pa.
646 Washington Blvd., Chicago, Ill.



(Continued from page 38)

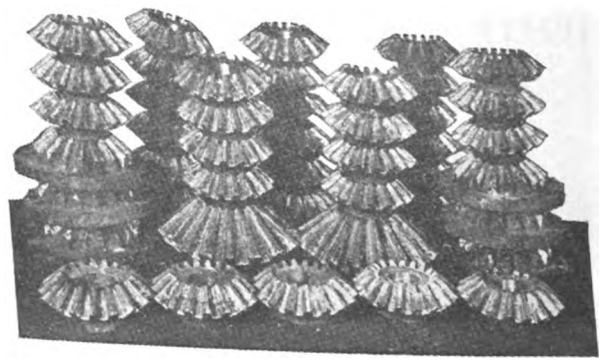
fitting. For small jobs such as rebabbiting bearings it is usual to do them on the job.

Breakdown repairs have to be made quickly and a stock of spare parts for all important units of equipment is desirable and necessary. These should be kept in the maintenance department stockroom and when a part is used another should be ordered. When large parts break on cranes, elevators or other equipment a portable welding outfit is the most economical way to make the repair. If a forge shop is available new parts may be quickly made up. Sometimes it is necessary to mold new parts of cast iron or composition using the broken parts as a pattern. Spare parts should be held in stock for all breakable parts on elevators and cranes and for any other equipment that is considered as important as these. With a group of machines of the same design and size an ample supply of spare parts may be stocked without being considered extravagant. To facilitate quick repairs well equipped and fitted trucks are necessary to carry tools and necessary repair materials to the job. Often an electric truck is fitted up for this service.

A well organized inspection of the various units of equipment will go a long way toward eliminating breakdowns and will allow the repairs to be made in a systematic way before a break occurs. After the record system noted above has been in effect for a few years it is easy to have in stock most all the parts that are apt to wear out or become broken in regular service. Much of the work of this department is closely connected with the work of the millwright department. Especially is this so of the breakdown repairs on cranes, elevators and other large equipment on which work the two gangs often work side by side. It is therefore desirable to have close coöperation between these two departments so that the time for repairs will be cut to the minimum.

Motor trucks can be used instead of freight cars for the interstation movement of freight within terminals. The truck is a better vehicle for this service. It can do its work quicker and cheaper than the freight car.—*Prof. Emory R. Johnson, University of Pennsylvania.*

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TIOGA STEEL & IRON CO. | Wm WHARTON Jr. & CO. Inc. | PHILADELPHIA ROLL & MACH.



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Deliveries Prompt. Service Excellent.

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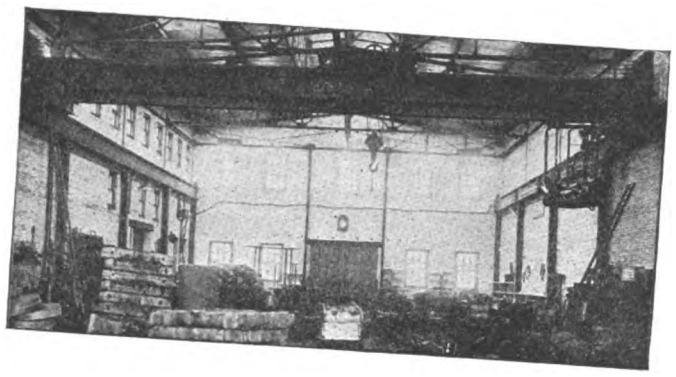
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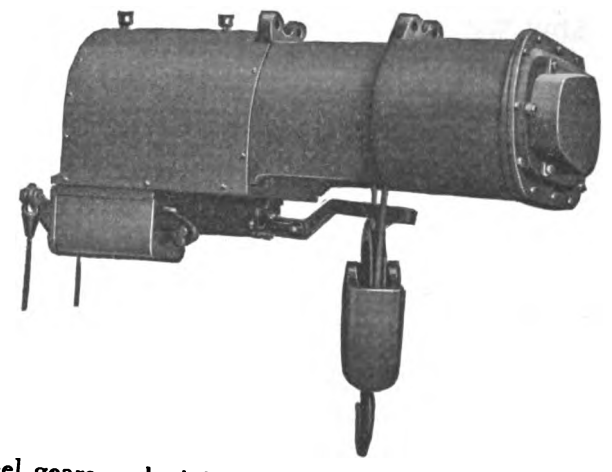
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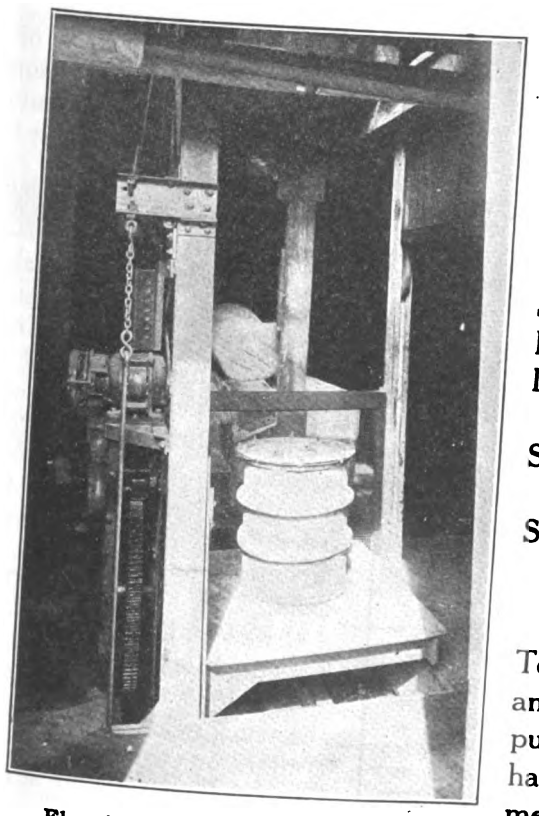
Cut steel gears and pinions running in oil.
Roller bearing. — Short headroom.
The construction is simple and built for service.

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That ELEVATING PROBLEM May be Solved by a Standard or Special "DELTA"

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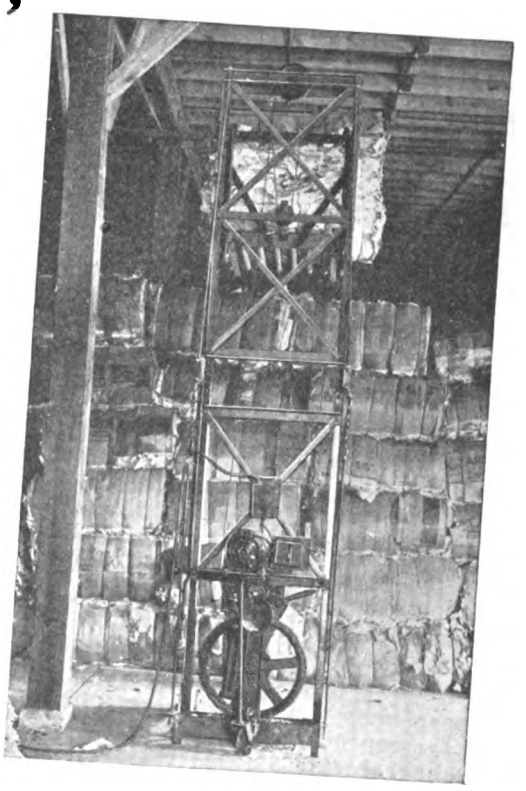


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SINGLE DRUM, TWIN DRUM OR 4 POST MACHINE FOR PORTABLE OR FIXED USE.

CAPACITY—Whatever you need.
SPEEDS—Up to 80′ per minute.
PLATFORMS—Any size you want.
LIMITS—Electric top, bottom and intermediate if needed.
SAFETY—Does not depend on any mechanical adjustment.
SIMPLICITY—Mechanical knowledge is not necessary either to care for or operate.

Tell us what your elevating problem is and we will show you a DELTA for the purpose. We have 60 standard sizes, hand power and electric for prompt shipments.



Electric DELTA handling baled stock.

NEW JERSEY FOUNDRY & MACHINE CO.

90 West Street, New York City

80 Distributors

Incorporated 1885

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Helping to Solve the Nation's Transportation Problem

(*Continued from page 22*)

and on the move to be a profitable investment. This can easily be accomplished by the use of one or more of the many forms of trailers which are applicable for the particular kind of commodity to be transported.

Trailers fall into four general classifications, according to type. (1) Four-wheel trailers; (2) two-wheel trailers; (3) semi-trailers; (4) pole or pipe trailers. The four-wheel trailers are subdivided into reversible and none-reversible types; light high speed trailers, for use with passenger automobiles, heavy duty trailers hauled by motor trucks for general haulage purposes, straight frame and drop frame models, and slow speed trailers with dump bodies for use in trains with tractors. Almost any type of body can be mounted on the four-wheel trailer, and many different types on the semi-trailer and the two-wheel trailer. The pole or pipe trailers are not intended to carry bodies, but instead are provided with bolsters to retain their load.

There is no doubt that in the majority of cases, industries are now paying excessive costs for their intra-plant haulage, which costs could be materially reduced by the use of some form of trailer. The Buick Motor Company, at Flint, Mich., should know the value of motor trucks, and the fact that they are using semi-trailers on their intra-plant hauls is more or less of an endorsement for such equipment.

Any vehicle that can be attached behind a motor truck or tractor is not necessarily a good trailer. Trailers should be designed and constructed with much care and skill, and the selection of the proper type naturally depends upon conditions and the commodity to be hauled.

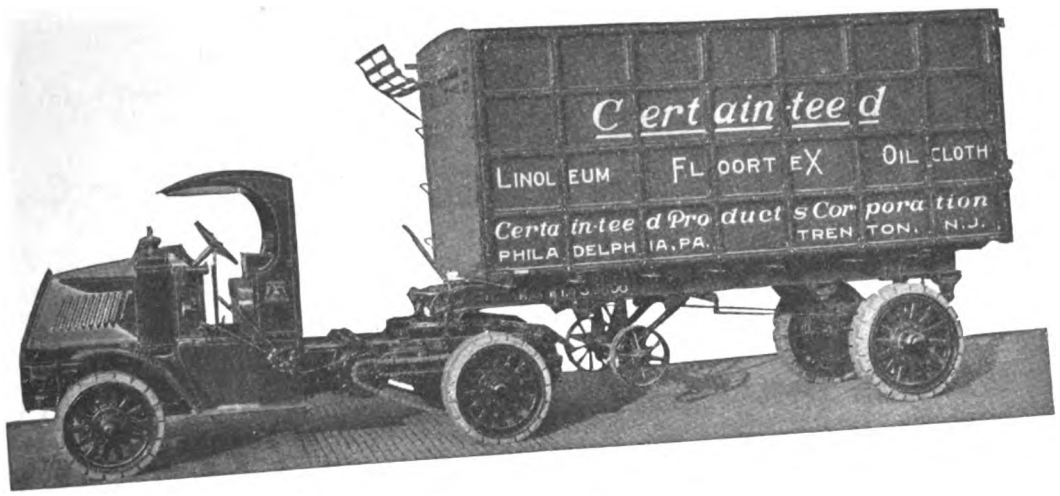
Trailers have six major functions: they increase load hauling capacity of the motor truck; reduce the cost of transportation, save waiting time for motor truck while loading and unloading; move objects that cannot be carried on motor trucks alone; take care of excessive loads and peak haulage; and enable passenger automobiles to be used for freight haulage purposes.

Great savings are possible by the use of trailers for hauling bulky materials, which take up a great deal of space in proportion to their weight. Trailers are also used to haul long lengths which will not go on the truck alone. The strongest arguments in favor of the trailer's use as an auxiliary to the truck are increased carrying capacity and reduced handling costs.

If one trailer is used it can be loaded while the truck is making a trip alone, and be picked up by the truck every other trip. Two trailers or two semi-trailers can be used to still better advantage while a fleet of three for each truck makes a very efficient hauling unit, especially where loading and unloading takes up a large part of the truck's time. In the latter case, when using trailers it may be found good practice to use the truck only as a tractor, and keep it in motion almost continously. One re-

(*Continued on page 44*)

A STEP BEYOND THE TRUCK



Common Sense in Hauling Leads to

LAPEER SEMI-TRAILERS

Because they mean "Maximum Work at Minimum Cost"

When it is considered that the use of Lapeer Semi-Trailers means trebling the hauling capacity of the motor, reducing the hauling cost to one-third, and eliminating the idle time of motor and chauffeur during loading and unloading, it is understood why the motor truck, as a hauling unit, is giving way to the tractor-trailer method.

Those facts explain why the number of Lapeer users has been more than doubled during the last year.

There are, of course, the exceptional features of Lapeer equipment to be considered. The entire operation of Lapeer Semi-Trailers is controlled by the chauffeur from his seat in the cab of the tractor. Coupling and uncoupling are effected automatically, without the aid of any device. The semi-trailer brakes apply automatically, or the automatic brakes may be disengaged and the braking of the trailer entirely controlled by the chauffeur from the tractor cab.

The Lapeer Semi-Trailer, when detached, is a complete vehicle, the front support wheel assembly enabling easy mobility by hand or otherwise.

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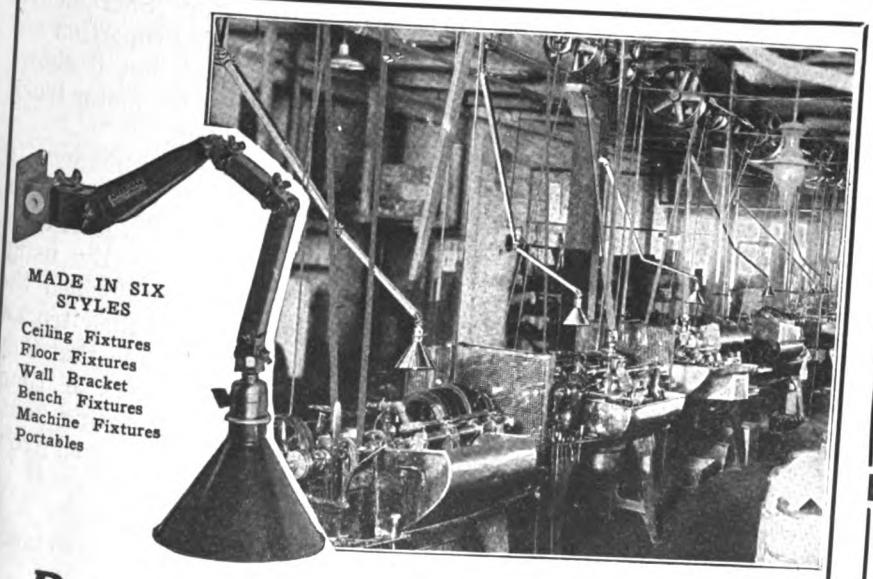
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Ceiling Fixtures
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Better Light—More Work

Wasted motion, shadows cast by heads, hands and fingers, eye-strain and fatigue, breakage and "rejects" are costly production handicaps that can be immediately minimized by "American" localized light fixtures.

The universal joints permit the operator to place a good strong light in any position and hold it there indefinitely. Made of strong sheet steel, firmly welded at each seam, these units will last forever. Wires cannot become kinked; all danger of short circuits eliminated,—approved by Underwriters Laboratories.

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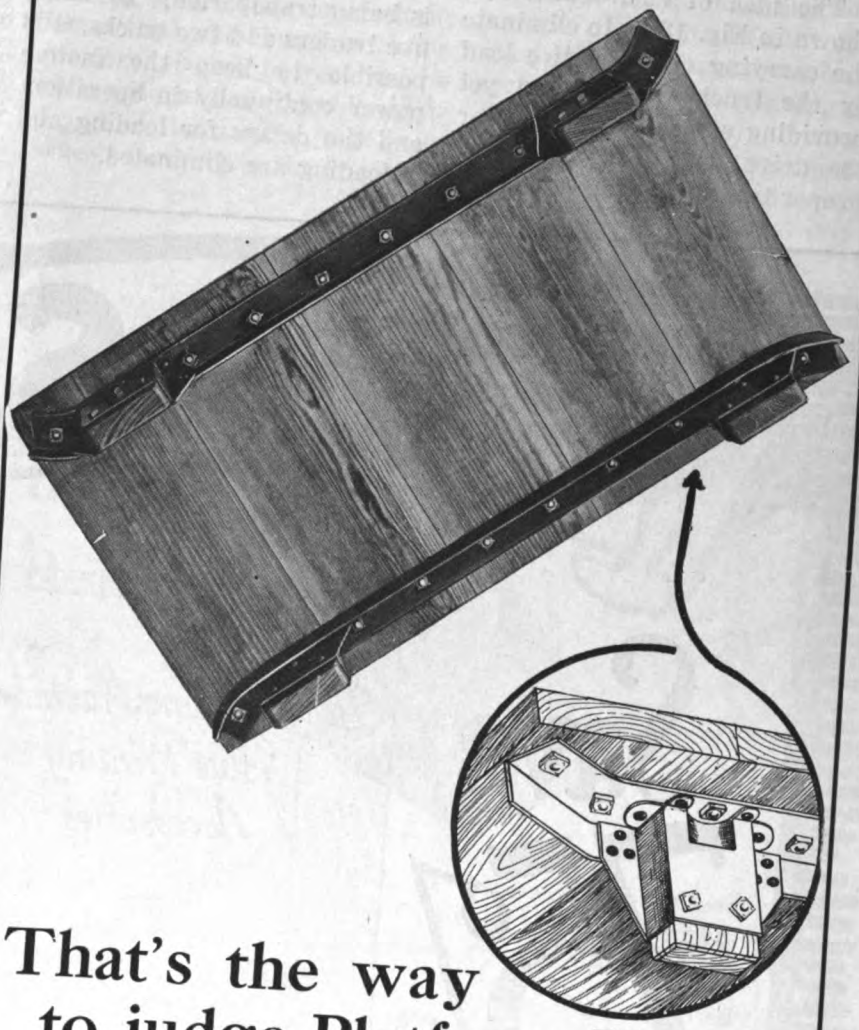
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MILWAUKEE WISCONSIN



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From The Bottom Up



That's the way to judge Platform Values

That's the way we want you to judge "Hallowell" platforms. Forget all about the nice, shiny top and closely examine the parts that have to stand the strain.

Notice how the leg supports are attached to the runners —in the "Hallowell" platform *hydraulically driven rivets* are used; no bolts. This type of construction is the strongest yet developed.

There are three different types, "A," "B" and "C," making a very complete line; one or all of them will suit you.



HALLOWELL

STEEL LIFT TRUCK PLATFORMS

Made By

STANDARD PRESSED STEEL CO.,
JENKINTOWN, PA.

(The "Pioneer" Steel Hanger People)

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(*Continued from page 42*)

may be kept at each end of the haul, while the truck is in transit with a third trailer.

The idea of semi-trailers as shown in Fig. 12, is to eliminate the carrying of the entire load by the truck chassis, and yet providing sufficient weight over the drive wheels to guarantee proper traction. The semi-trailers as shown are self-supporting when waiting for loading or unloading, but the front wheels are elevated from the ground as shown in Fig. 11, when the load is being transported. By using five trailers and two trucks, it is possible to keep the motive power continually in operation, and the delays for loading and unloading are eliminated.

Fig. 13 shows a fleet of trailers used by the Chicago Mill and Lumber Company, Chicago, Ill., for delivering wooden boxes. With these trailers, it was found that five trucks could do the work that formerly required 15 trucks. In order to insure quick shifting of the trailers (which in this case are supported on jacks at the front end instead of wheels) when the trucks are out on delivery, an auxiliary front wheel as shown in Fig. 14 is employed, and the team of horses shown in Fig. 13 are hitched to the tongue, thus making the trailer into a wagon. Attention is again called to the method of supporting the trailer on a jack instead of wheels, as shown in Fig. 12. The third type of trailer support is shown in Fig. 15. The method of supporting a trailer should be given careful consideration.

On long hauls it is frequently more economical to use a four-wheel trailer which is coupled to the motor truck, and loads are carried both on the motor truck and on the trailer, as shown in Fig. 16. Industrial plants having branches in different cities, or where it is necessary to transport materials partly finished from one plant to another a considerable distance away for the final finishing, have found this type of trailer very efficient.

The load on the chassis guarantees the proper weight over the drive wheels for traction and the pulling of the loaded trailer requires very little power. As an example, Fig. 16 shows a four-ton trailer and a three-ton truck loaded with 12 tons of oranges, leaving Lindsay, Calif., for Sacramento. Overloads of this proportion are not recommended, but it shows the possibility of the motor truck and trailer system.

Fig. 17 shows the manner in which the Long View Orchards at Wenatchee, Wash., haul their apples to market. By using trailers, they have doubled the hauling capacity of their trucks, and it has been found that they have saved considerable time, and while the operating costs per truck have increased from 20 to 25%, they have made an enormous savings because it is not necessary to operate so many trucks.

Demountable bodies are preferred by some instead of trailers, although they are not similar equipment, as with demountable bodies the entire load is actually carried on the truck chassis. However, they permit as quick loading and unloading in the majority of cases as do trailers, and the operation is similar, *i. e.*, while the truck is busy conveying a loaded body to its destination, the second body is being loaded at the point of shipment, and the third body is being unloaded at the point of tion. Three things are happe-

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ing at the same time: loading, unloading and transporting. Upon arriving at its destination, the truck discharges its loaded body, takes on the empty body and returns. The empty body is exchanged for a loaded body in a very few moments, and the process is then repeated, keeping the truck and driver constantly engaged in actually moving goods.

In other cases, only two demountable bodies are used, and one is being loaded while the other is delivering its load in small orders and on numerous stops.

There are different types of demountable bodies particularly as to the method of placing upon, or removing them from, the truck chassis. Figs. 18, 19 and 20 show the method employed by a large paper concern for handling merchandise between factory and consumer. Fig. 18 shows the truck backed into place at the loading door. Fig. 19 shows the body being pushed forward on the overhead framework, while Fig. 20 shows the entire body supporting unit and method of loading bodies to trucks. Another view of similar equipment is shown in Fig. 21. In this installation the loading platform is inside the building and the trucks back into the building for loading, instead of pushing the body outside of the building on an overhead framework. In this installation more than 100 hand-chain blocks have been rigged up so that they are electrically operated. Each unit consists of four 2-ton chain blocks which are hooked on to the corner of the body so that the body can be lifted free of the chassis. The bodies are left hanging as shown, and are loaded or unloaded in this position. Attention is called to the method of supporting the body hoisting unit on I-beam trolleys so as to permit a slight longitudinal travel in case the truck does not back under in exactly the proper position to receive the body.

Building construction will not always permit the installation of overhead rigging, and so demountable bodies have been designed to operate on casters or wheels resting upon the floor. A wholesale grocer in Sioux City, Iowa, operating the equipment shown in Fig. 22 for delivering from warehouse to stores, has found that it is possible to use three trucks for 12 bodies. The particular design shown is arranged in such a way that by turning a hand crank, the truck driver can pull the body on to, or back it off of the truck chassis.

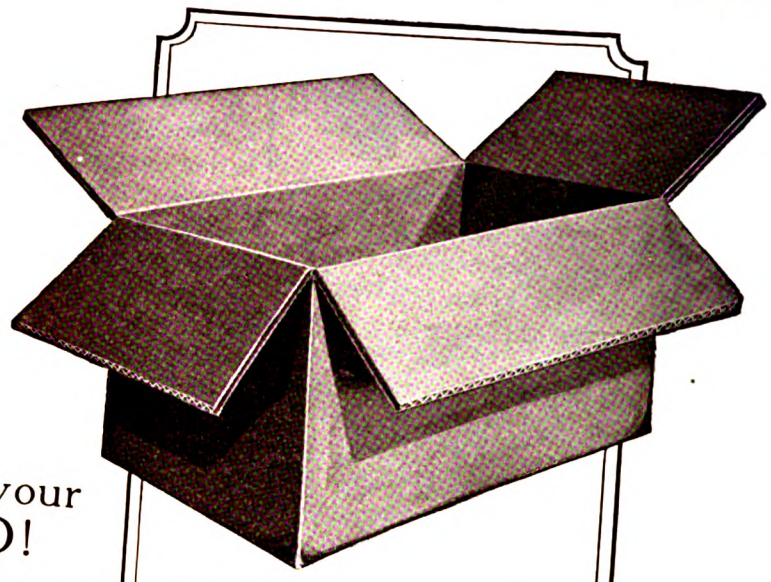
When using demountable bodies, the important thing is to properly arrange for the loading and unloading platform. Fig. 23 shows an ideal layout for the industrial plant, as it requires very little space.

One of the most difficult problems in the use of demountable bodies operating on casters or wheels instead of overhead supporting unit, is the proper aligning of the truck chassis with the platform, so as to receive the body without considerable shifting and to insure the body wheels running in the tracks on the chassis frame. Another objection is the blocking of the wheels and the levelling of the truck chassis with the loading platform when unloading filled bodies. One manufacturer of this equipment has designed a locking and truck aligning device which fastens to the loading platform and absolutely locks the chassis up and levels it

If there is a *Better Way* to Pack, H&D Will Find It.

BETTER boxes---for your products? Ask H & D!

If your shipments are not reaching their destinations safely---if freight costs are too high ---if it is taking too much time to pack---draw freely on the special box designing department of America's largest manufacturer of Corrugated Fibre Boxes.



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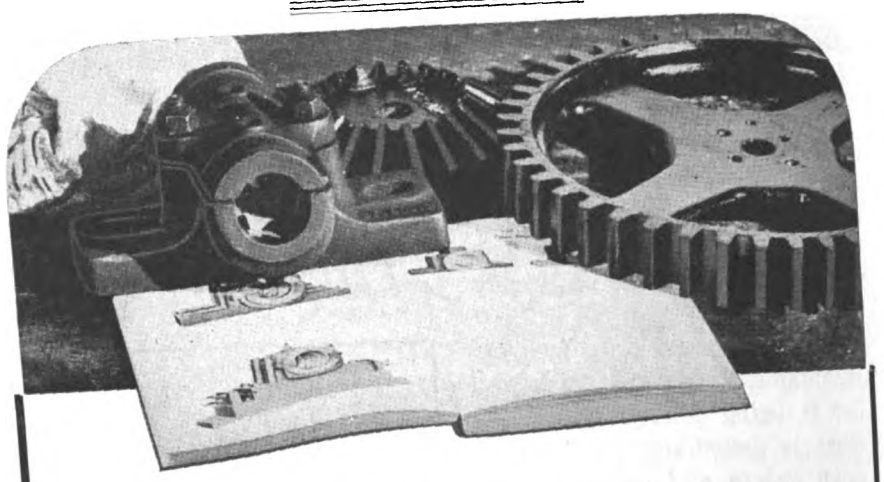
with the platform. This device can be seen at the end of the truck in Fig. 24, while Fig. 26 shows the locking jaws and the method of supporting this demountable body on the truck chassis.

The equipment from portable loaders to demountable bodies is applicable in almost all industrial plants, and will help to solve the motor transportation problems, but back of all these smaller problems looms the one big problem of future transportation. If we can solve that one big problem, and decide upon and install a national transportation system which will incorporate highway, railway and water transportation with the least possible friction and the highest possible efficiency, we will have solved a thousand smaller problems at one sweep.

The industrial executive is vitally interested in this big problem and as it is practically an economic necessity to reduce present costs of distribution, we should therefore consider the future of motor transportation in its broadest aspects.

Motor transportation can hardly be considered as a separate entity for its very existence is interwoven with that of the railways and waterways, and its future will of necessity be influenced by them. The railroads have been with us a long time, and have been proven satisfactory means of transportation for handling both passengers and freight over long distances. The motor truck has been with us long enough to establish its right to the short haul, although some question its right to the long haul. In order to refute this impression, we show in Fig. 25 a fleet of trucks in transit, which are employed by a national moving concern for long hauls. It is not unusual for trucks of this type to transport individual loads from New York to Chicago, and from New York to Buffalo, and on similar hauls of long distance. A number of these trucks have made trips covering 4,000 miles, before returning to the operating base. There are also many large industrial concerns transporting goods for a distance of from 100 to 200 miles, between factory and large cities.

These examples of actual operation open up a wide field for the motor truck on long distance haulage, and by using the accessories of semi-trailer, detached trailer and demountable



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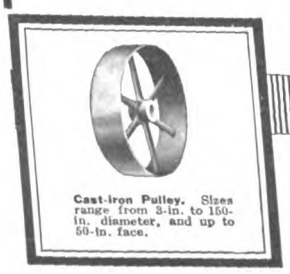
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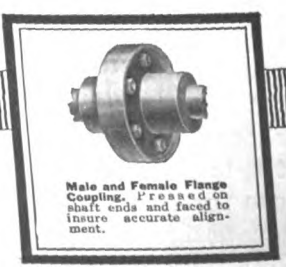
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bodies, the possibilities of the motor truck can be greatly enlarged, and while it is not feasible for all trucking companies and industrial plants to operate trucks on the long haul, these installations which are in successful operation indicate that the motor truck has its place in the national transportation system.

The conception and installation of the container cars shown in Figs. 29-30 (and on the cover of this magazine) is a big step toward solving the country's transportation problem. The use of this class of equipment means saving time, less confusion, damage and money in transportation, but it means more than that. It means real efficient coöperation between trucks and railroads, a consummation greatly to be desired. The mission of the container car is to expedite delivery of less than carload volumes of freight. Its use calls for coördination of carriers, steam and electric railroads and motor trucks.

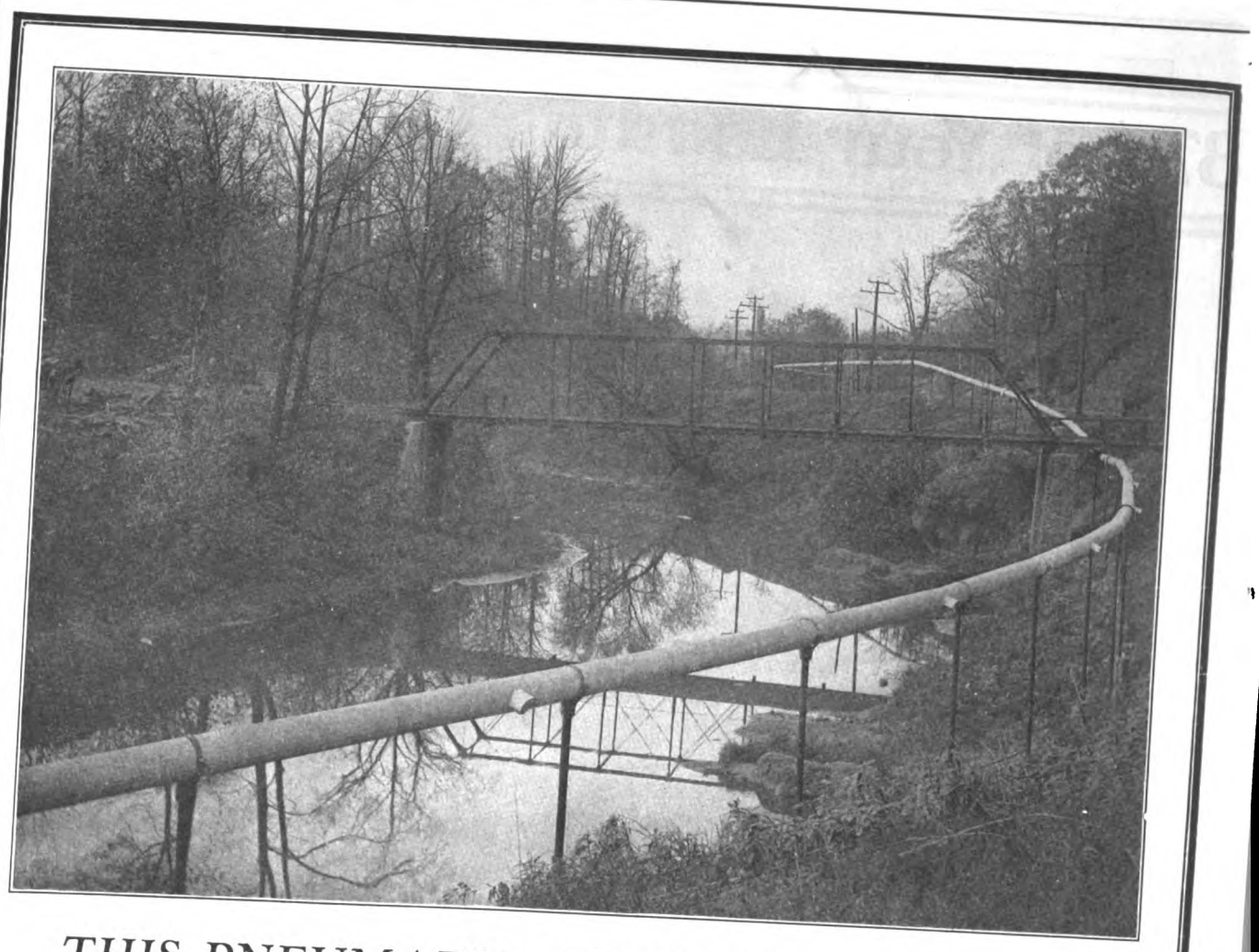
The container cars have many advantages: (1) the elimination of the handling between shipping and receiving points, (2) eliminates the need for costly crating; (3) they also make necessary the use of fewer checkers and clerks. (4) Then, too, prompt unloading to motor trucks eliminates demurrage. (5) Their universal use would permit industrial plants to be located irrespective of the proximity of railroad tracks, and would do away with the expense of spurs and sidings.

In Europe for many years the sectional or demountable freight car has been employed, and an illustration of such a car is shown in Fig. 27. This car carries two demountable containers, and has been operating for some years handling crushed carbide between a large carbide plant in Switzerland, and a fertilizer plant in Bavaria. The practicability of the container unit is here demonstrated, because carbide is one of the most difficult materials to handle, due to its affinity for moisture, which must be carefully guarded against as moisture in contact with carbide forms acetylene gas which is explosive.

It will be noted that the European railway cars are much smaller, being not quite one-half the size of an American flat car. Many of the industrial executives who went to the front will recall the size of these cars. The efficiency of the idea, however, has been proven, and an American railway system known as the Detroit United lines is now employing like equipment, and coördinating the motor truck and the railway. Fig. 29 shows demountable bodies ready for unloading to the platform where they will be transferred direct to flat cars especially constructed to hold the containers in place, it being possible to place four of the larger, and eight of the smaller on each flat car.

Furniture, mail and express is handled on the continent of Europe and in England by this system, often using automobiles, boats, and railway trucks all during one trip.

Similar equipment, but of heavier construction is also being used by the United States Government for the transportation of mail between New York and Chicago. This month's cover shows the heavy construction of these containers, and the method of unloading same from flat cars to mail trucks. Each flat car can carry four or six of



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these containers, depending upon the size used. The containers used for mail are made of steel and besides being fire and weather proof, are made burglar proof, by setting them on the car in such a manner that the doors, even if they could be unlocked, cannot be opened without hoisting the whole compartment above the steel bulkhead behind which it fits.

Interchangeability is the keynote of Success, and this demands standardization, not of the transportation units, but of the containers which will be interchangeable by each and all.

The limiting factor in this chain of coördinating waterways, highways and railroad transportation is the motor vehicle, and since the greatest trucking economies are obtained through moving the maximum load, containers should be to the maximum of truck capacity. The unit container in itself makes possible enormous motor truck operating economies for our common carriers, as it will conserve the high cost of truck idle time now paid by shippers in tariffs covering the costs of truck operation by present practice.

In addition, with such possible trucking economies, enormous labor conservation and money savings will accrue to the carriers when this equipment is put into universal operation. Thus the container can be made the Missing Link in transportation, for it can be made to lace up into one comprehensive system, for through movement, all existing disjointed units.

By present practice, there is much cross and back hauling of empty gondola cars, allotted to certain commodity freight service. The gondolas can be utilized for merchandise freight service with the container as an accessory for transportation, and their empty returns, now at a total loss, can be converted into profitable merchandise transportation movements. In the motor truck, our common carriers have now available a supplementary unit for their transportation plan. To date the consideration of such by the carriers has been limited almost exclusively to complaint of its inroad on their business, and in the hand of wild-cat operators on their tariff expectancies.

In other words, the interest of the railroads in the motor truck has been destructive instead of constructive. The potency of the motor truck will ultimately force railroad executives to adopt and use it as an adjunct to their own facilities. It is therefore necessary for progressive plant executives to understand the true value of the motor truck, and its proper place in the national transportation system so that they will be prepared for the new conditions which will shortly exist. And they should be in a position to converse intelligently on the subject.

Within the last two years the American people have begun to realize that the proper solution of the immigration problem is a matter of vital importance to the country. An article in the January issue of the *Monthly Labor Review* entitled "A Century of Immigration" shows the menace to our national principles and ideals involved in the vast tide of immigration, which in the past fifteen years has amounted to nearly 10,000,000 persons.—*U. S. Department of Labor.*

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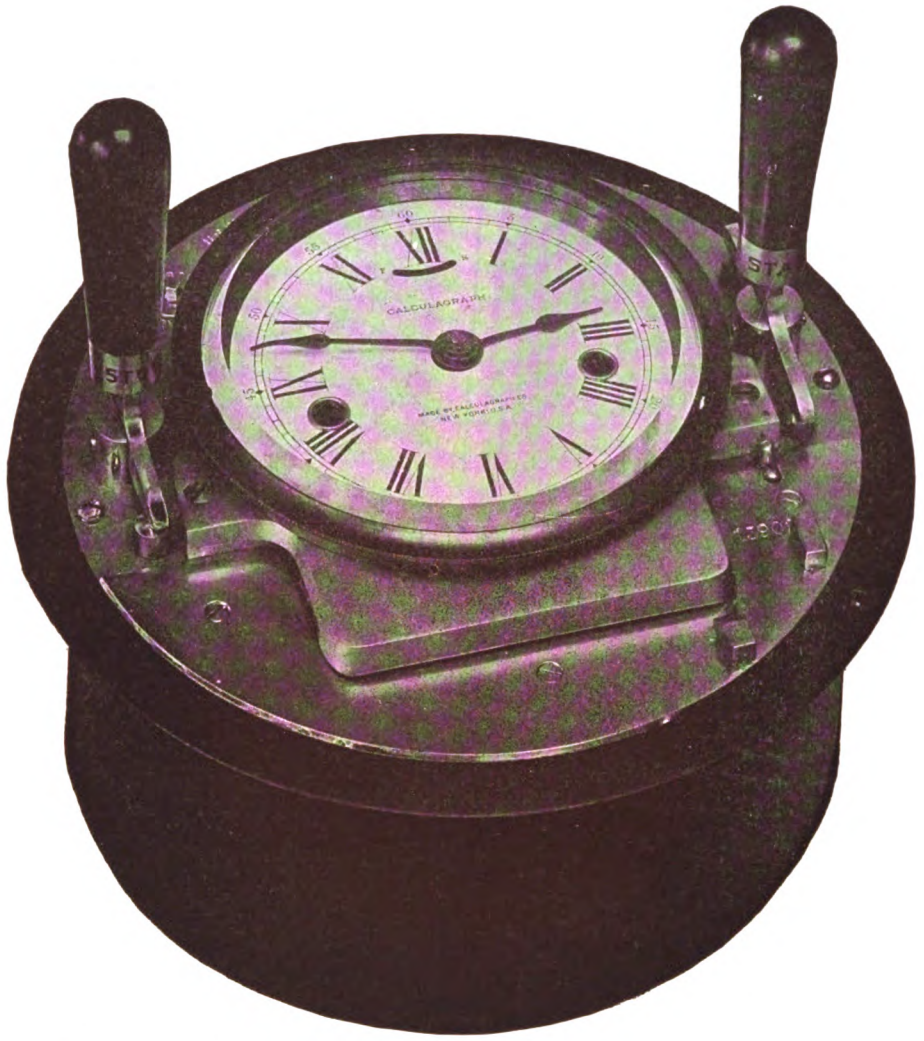
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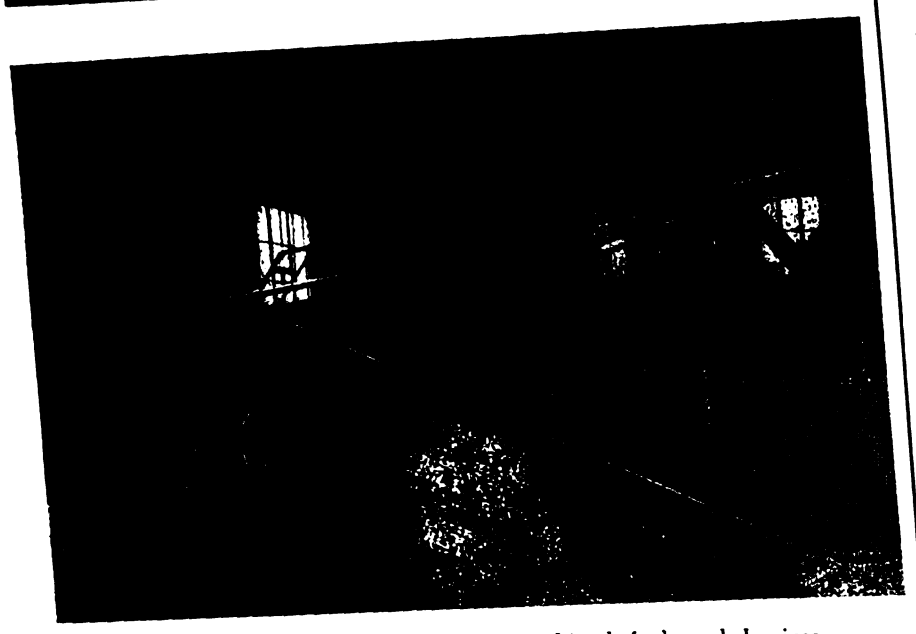
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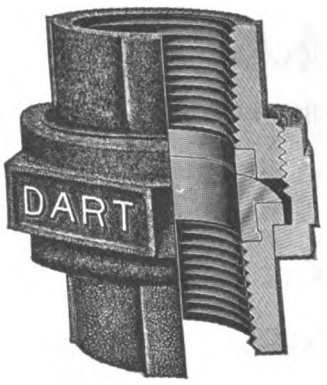
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Electric Welding and Its Applications

(*Continued from page 28*)

is scarcely a welding method, being limited to the production of the necessary heat. The process is sometimes termed the water-pail method. A wooden tank is filled with some suitable electrolyte—as, for example, sodium carbonate or potassium carbonate. In the liquid a plate, which is connected up with the positive pole of a source of current, is immersed. The work which is to be heated is connected up with the negative pole and then immersed in the electrolyte. The passage of the current heats the work. When the temperature is judged right, the work is withdrawn and the actual welding effected by hammer and anvil or some equivalent means of producing compression.

The art of uniting metals by means of the heat created at the seam by the resistance of the seam to the passage of the current is, it is in effect claimed, an American development. It appears that Elihu Thomson conceived the fundamental idea as far back as 1877. But his first patent was not obtained until 1886. This is a mechanical method, being more or less dependent on compression. Apparently, there is no purpose to create an arc, but merely to develop the heat by simple resistance to the passage of the current. When an arc is produced, we have a stream of fine particles passing from the positive to the negative electrode. Whatever constitutes the positive electrode, whether the work itself or a rod, this electrode supplies the material out of which the arc is made. The stream of particles is incandescent and is presumably the chief source of the heat used in the welding. With resistance welding, no arc is necessary. No stream of heated particles is sought or required. The heat is developed locally because the current is hindered at the seam by the reduction in conducting capacity.

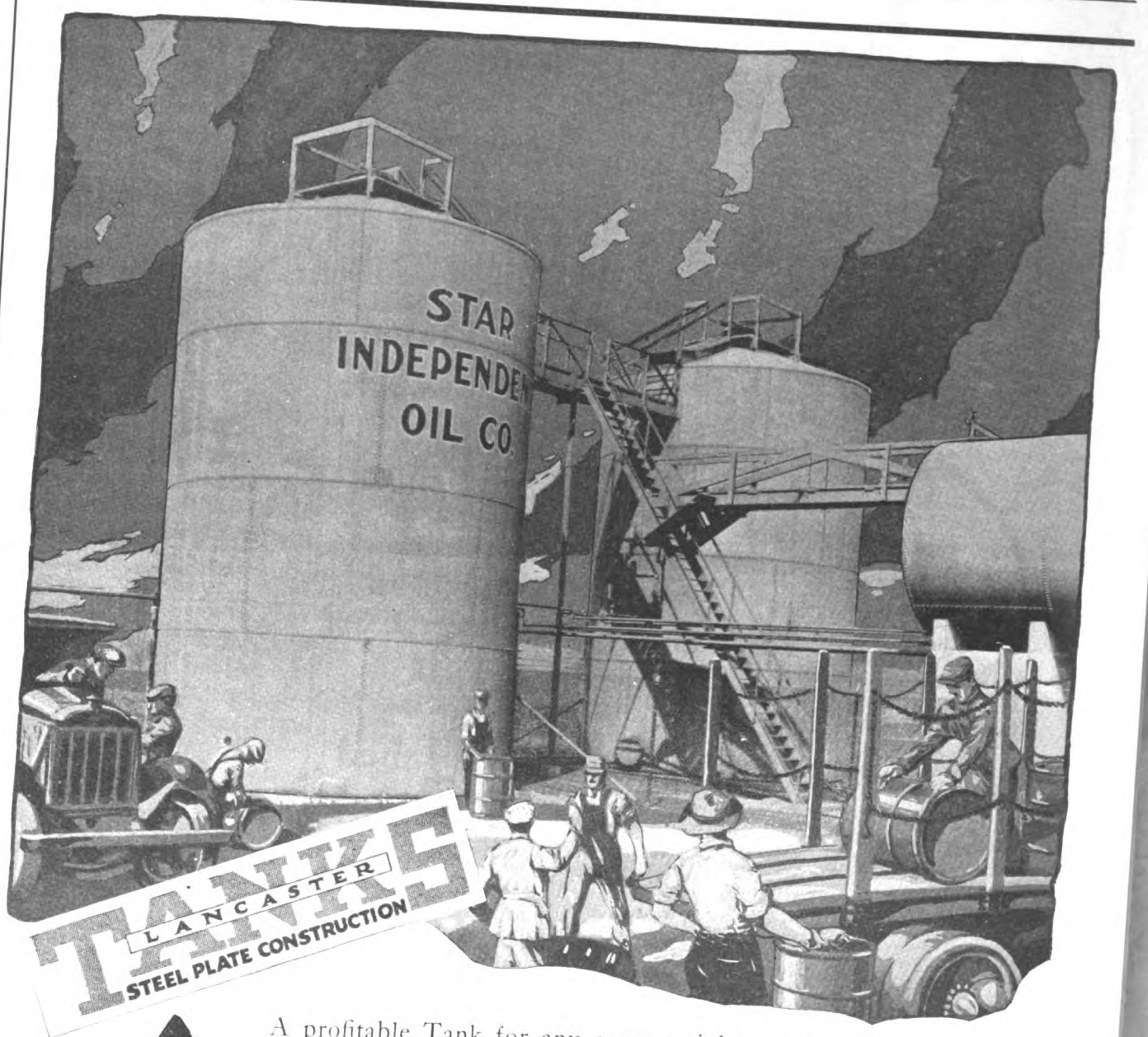
In the early stage of the development of resistance welding, it was found that the jaws of the machine which held the two parts which it was desired to unite, required artificial cooling, which was supplied by a system of water-cooling.

Resistance welding may conveniently be regarded as divisible into butt welding, spot welding, point (or projection) welding, ridge welding, and seam welding. What is known as percussive welding is an additional form, which may be classed with the other processes of resistance welding.

Apparently, Thomson's first patented device (1886) did not provide for pressure at the moment of welding but depended rather upon fusion and maintained contact. It is said that a patent, issued in Germany to De Bernardo in 1888, was probably the first to cover the matter of electric welding under pressure.

At the present day, resistance welding is chiefly carried out by the aid of machines. Alternating current may be used in certain devices, particularly machines employed in butt welding. In fact, single-phase current of practically any usual commercial voltage and frequency—as,

(*Continued on page 53*)



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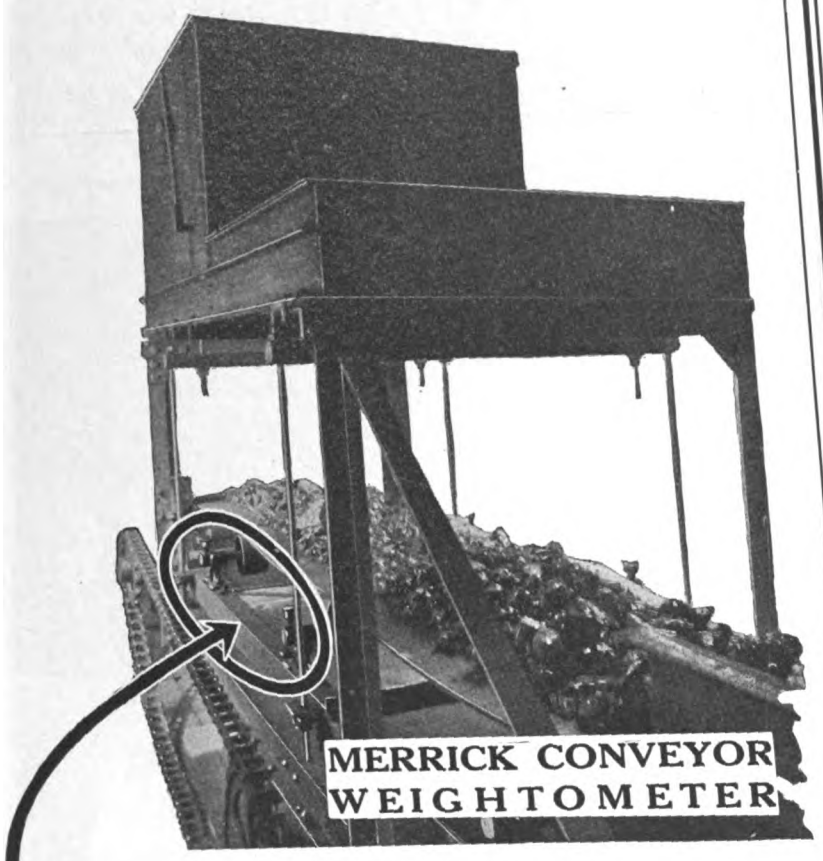
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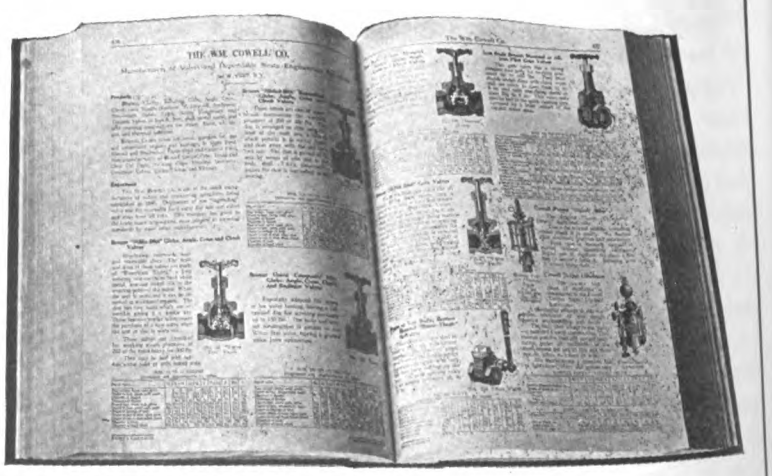
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(*Continued from page* 51)

220, 440, or 550 volts, 60 cycles —may be employed.

The two general processes—arc and resistance welding—have their respective fields, which doubtless overlap more or less. But we need both processes for the work that may very well be done by electricity.

In general, direct current is employed in welding by the arc process. It is explained that with the alternating current, the heat developed at the ends of the arc—that is, at the electrode and at the work—will be the same. This is to be considered as inherent in the very fact of alternation. With the direct current, on the other hand, the current is always going in the one direction. The result is that considerably more heat is developed at the positive electrode than at the negative.

There are certain claims that have been put forward on behalf of the advantage properly belonging to arc welding that have practical importance. In the first place, if a metallic electrode is employed—presumably with direct current—welds may be made overhead and in vertical situations. That is to say, the arc may be made to carry metal from the electrode into the location of the weld and thus build up without difficulty an overhead or vertical seam, the effects of gravitation being effectively overcome.

The arc method is competent to weld steel, cast steel and cast iron. This seems to be a limited list. However, these metals are so universally used that the field is still a very large one. Those interested in the non-ferrous metals will naturally note the exclusion of copper, brass, aluminum, etc. It is possible that some development may have been made along these lines, but I doubt if matters have gotten to a thoroughly commercial point.

Another advantage claimed for electric arc welding is the high temperature available. It is estimated that this temperature lies between, say, 6000° and 7000° F. The reader who has not sufficiently considered the question may wonder why so high a temperature may be desirable. The thermal level is, indeed, much higher than that required for the melting of the metal. But high temperature appears to be the only thing capable of producing *in the metal of the work* enough heat to melt it, when so unsubstantial a means as the electric arc or the gas flame is employed. Quantity of heat and a moderately high temperature are both requisite to fuse the metal.

In so inconsiderable a weight of material as that which constitutes the arc or the gas flame, the quantity requirement can only be met, apparently, by using an excessively high temperature. We have here the apparent reason why the oxy-acetylene process seems to be superior to the oxy-hydrogen procedure, when welding is in contemplation. At or near the terminus of the little white pencil-like flame of the oxy-acetylene torch, we get a temperature understood to lie between 5000° and 6000° F. The inconsiderable weight of material in the arc, accordingly, means that we must have an excessive temperature in order to get the amount of heat required.

One of our largest companies manufacturing electric equipment supplies arc welding appliances, whose operation is based on the one-carbon system. However, instead of the hard carbon formerly employed, they substitute graphite. The electrode is baked at a temperature of about 3600° F. and in consequence the binder employed is graphitized. This is said to improve the bond between base and binder and also the homogeneity of the whole electrode. It is claimed that the substitution of graphite results in a lower consumption of electrode material and in a softer weld (*i. e.*, in a weld containing less carbon).

It will be of interest to have before us some of the important details concerning the arc formed with this type of electrode. After the arc is once formed, one end of a rod of suitable metal may be introduced into it from the side. The object is to supply fresh metal for use in making the weld. The arc carries metal from this rod down into the hollow of the welding surface. This hollow, or crater-like formation, is created by the arc.

Imagine the arc extending from a tapered graphite electrode to a crater or hollowed out place in the metal of the work. In general, it is advantageous that the electric connections of work and electrode be such that the work is positive and the electrode negative. This gives, usually, a higher concentration of heat at the end of the arc next the work. In fact, this concen-





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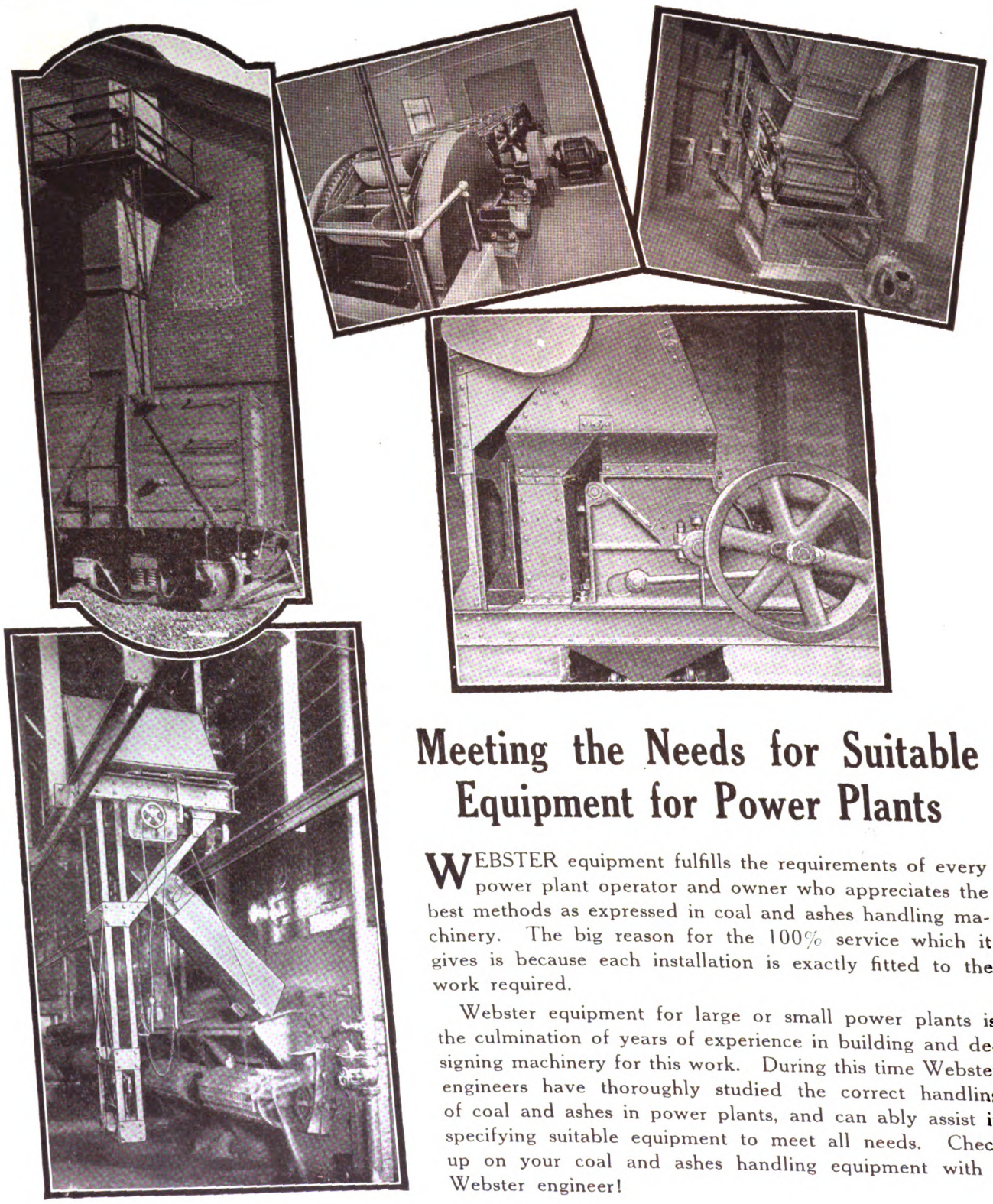
tration of heat may often be used, if desired, to cut through the work.

Now, the arc may be manipulated so as to be long or short. It is recommended that short arcs be employed. The reason is interesting. The arc stream consists of two parts—(1) a central core, and (2) an enveloping sheath. The core will be a white, and the envelope a blue. External to both will be a yellow flame. The arc stream consists of a central core of electrically charged particles and an envelope of hot gases. The electrode material is conveyed in both liquid and vapor form across the arc, a spray of small globules being discernible with some types of electrodes. Since atmospheric gases tend to diffuse through the incandescent metal stream, it is obvious that some of the conveyed material becomes oxidized. Through the maintenance of a short arc, not exceeding 1/8 inch, the resulting oxidation is a minimum because enveloping metallic vapors serve as a barrier to restrict the further diffusion of atmospheric gases into the arc stream. However, in practice, oxidation is wanted, as it is by means of it that the carbon from the graphite electrode is oxidized and thus prevented from impregnating the metal of the weld. If impregnation were allowed, hardness of the metal in the weld would result. The length of the arc required for the consumption of the carbon varies with the amperage of the current employed. On the other hand, the arcs must not be too long, as the protective envelope is then liable to deflection and the exposed stream of metal to oxidation. For a current of 500 amperes, the arc should generally have a length between 3/4 and 1 1/2 inches.

It is claimed that the graphite electrode may be used in the arc process for the welding of cast iron, cast steel and non-ferrous metals. Further, it is also claimed that cast iron may be cut, and also cast steel and non-ferrous metals. The cuts are rough and apparently consume a considerable quantity of the metal. This will be of small importance in certain cases—as, for example, in those where the risers and rough fins on castings are to be cut away. Other claims refer to the melting and cutting of scrap metal, the remelting of a surface to improve its appearance, to the deposition of hard metal or the hardening of a surface by impregnation with carbon, and the automatic cutting and welding of sheet metal. It is also said that the process may be used to preheat the metal of a welding job for the purpose of taking care of expansions and contractions.

We are not to conclude, however, that the arc process employing a graphite electrode monopolizes all the foregoing applications of the electric arc in connection with welding and cutting. Other arc processes cover much the same field.

Cutting with the electric arc is quite different from the cutting process carried out by a high-pressure oxygen stream acting in conjunction with a heating operation carried on by an oxy-hydrogen or an oxy-acetylene flame. The gas method seems to act in part by a destruction of the integrity of the steel brought about by the oxidation of the contained carbon and perhaps also by an oxidation of the iron as well. With the electric arc, the cutting action seems to consist principally of



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localized melting. The cut is made because the metal fuses and blows away. The operator, consequently, advances the arc at just the rate at which the metal fuses and flows out of the cut.

The following details will give an idea of certain features of arc cutting. Two 8-inch cuts were made in ship plate ½ inch thick. In the one case, an arc made by a 250-ampere current was employed. A cut about ½ inch wide was made in 2½ minutes. In the other case, a current of 650 amperes was employed with the result that a cut 0.8 inch wide was made in 1 minute.

A great advantage of the arc method of cutting consists of the circumstance that non-ferrous metals may be cut. In fact, cast iron may be cut with the arc. A particular application, of importance in the operation of blast furnaces, consists in the "burning out" of tap holes and the melting or cutting of iron which has "frozen" in furnaces of this kind.

As to the welding of copper and copper alloys, the use of the arc appears to be yet in the early stages. When the oxy-acetylene process was first introduced into the United States, it appears that some expected that all metals could be welded, and a certain amount of disrepute was perhaps acquired because of a failure to appreciate the special problems due to the physical and chemical characteristics of copper. Just how far along the arc people have gotten, is not apparent. Copper welding with the oxy-acetylene flame is now pretty well developed.

Other non-ferrous metals—as, for example, aluminum—that are of importance in the industrial world have their individual characteristics just as well as copper and the copper alloys. And these characteristics play roles of greater or less importance in welding operations. So that it is necessary to study the various metals and to take into account their individual peculiarities, if electric welding or any of the new methods is to be employed with them. In this matter, it may be that the oxy-acetylene people are further along. And doubtless, some of their experience will be of value to the electric people. It is said by the company already referred to that copper and bronzes (alloys of copper and tin) have been successfully welded by means of the arc method, using the graphite electrode. A welding rod of bronze low in tin and zinc is mentioned in this connection. It is also required to be high in phosphorus—not less than 0.25 per cent. being specified. This last is undoubtedly a provision against oxidation of the copper, the phosphorus acting as an oxygen absorber.

Of what material or materials should the electrode consist? This has been a very live question among those interested in arc welding. From what has already been set forth, the reader may gain the impression that at least one large concern has committed itself to the carbon electrode—that is, to the electrode made of carbon in the graphite form. Another concern, claiming to be the largest welding organization in the world, says: "According to our experience, we believe that the chemical composition of the electrode is of less importance than a uniform granular structure. The physical properties of the electrode affect the stability of the arc more than they do the

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physical properties of the finished weld."

Some electrodes are used bare; others consist of metallic rods covered with a coating or sheath of fluxing material. "It is found that flux coatings are desirable in many cases, partly on account of their stabilizing effect on the arc and partly on account of their value as fluxes in cleaning the weld of certain impurities."

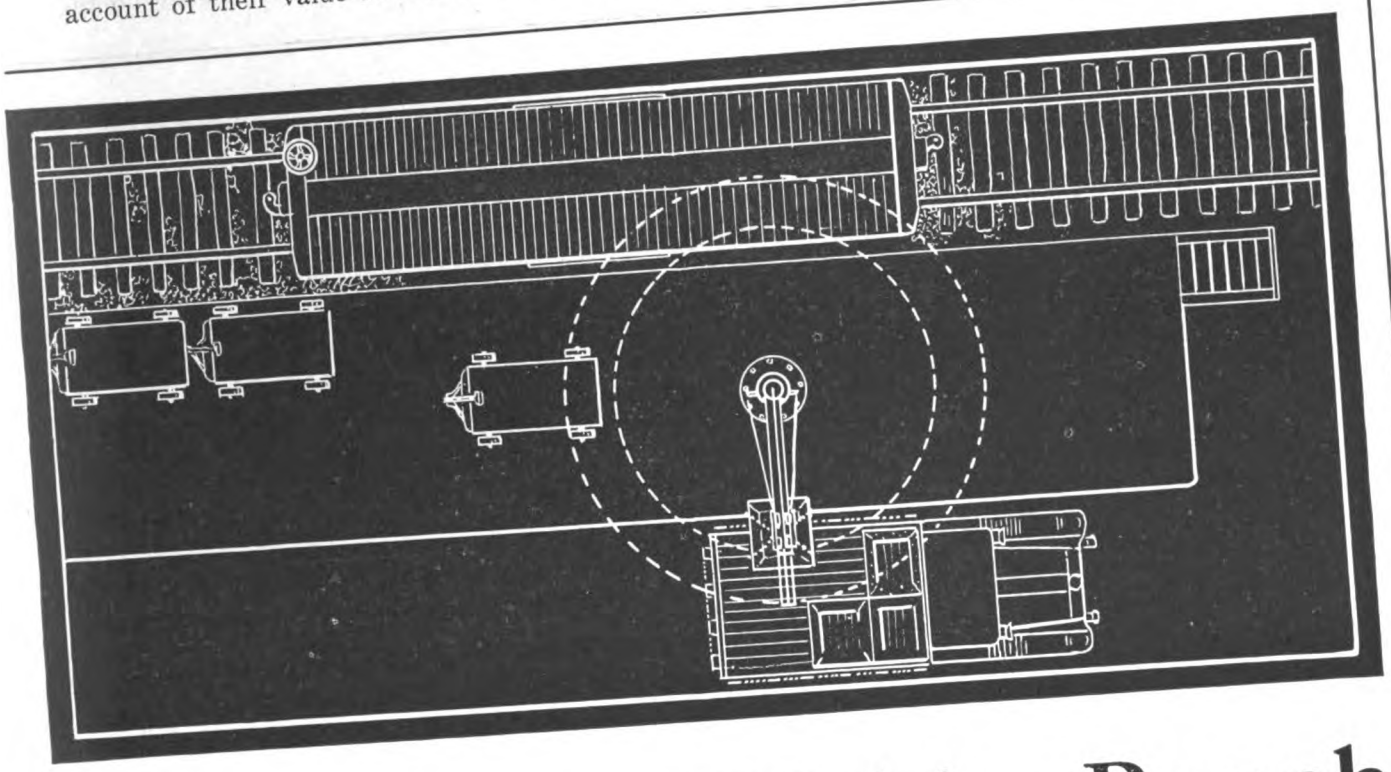
We are to understand the foregoing to refer particularly to iron and steel. "When it comes to welding bronze and other non-ferrous alloys, the choice of material in the electrode is of great importance." And further: "There is so little known of this branch of the art that those who know consider it the best policy to hold secret the little knowledge they have."

Let us, however, consider briefly the metal electrode. With this type of terminal, we do not need a special welding rod as a source of supply of fresh metal for the weld. The electrode itself is the source of supply. Metal melted from the electrode is deposited in and becomes a part of the weld. We have here a situation somewhat different, apparently, from that which exists when using the graphite electrode. We find that under this system, the amperage of the current controls to a large extent the length of the arc. When a metal electrode is employed, it is apparently not so much the amperage of the current as the situation of the point at which new metal is to be deposited. Shortness of arc is desired as a means of minimizing the oxidation of metal flowing from the electrode. But situations arise where the welding is to be done on a projection or down in a deep and narrow gap. Here a long arc is desirable, because such an arc enables the operator to maintain the arc while manipulating the metal. "The stability of the arc and the tenacity with which it persists increases with the length."

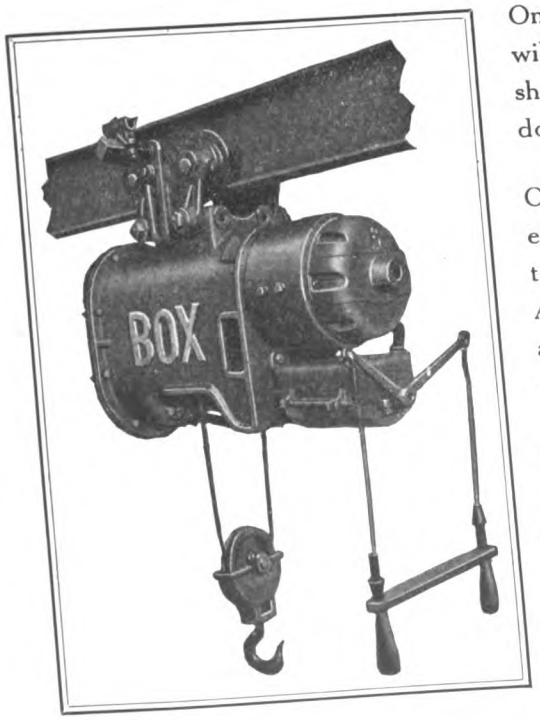
The diameter of the metal electrode is a matter of importance, since in general it is easier to make a good weld with an electrode of small diameter. The reason given is that, with a small electrode, the operator is compelled to carry the arc all over the surface of the joint. If the welder has a big, powerful arc, it is rather easy for him to get a good flow of metal and fill up the joint without going over all parts with the arc.

It seems to be pretty well understood that successful welders operating with the electric arc require training. It is not an art which just any common laborer can acquire. Intelligence is required. To intelligence must be added information and experience. There are schools for the training of operators. Then there are opportunities for learning the art as an apprentice or helper.

Electric arc welding can be applied to an exceedingly large variety of work. Broken castings, whether new or old, may be restored. The running of seams connecting up plate metal is a class of work to which the arc is adapted. In structural steel work, the arc finds opportunities. An example or two will illustrate this class of job. A structural steel column consisting of an H-bar is to stand on a base plate. Arc welding is applicable here in securing the base plate to the foot of the column. Again, a crane bracket may be wanted for support on an overhead traveling



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The bracket itself may be secured together by the electric arc and then by the same means affixed to the supporting column. Standard steel shapes may be cut so as to form the peak of a roof truss. The parts may all be joined together by arc welding.

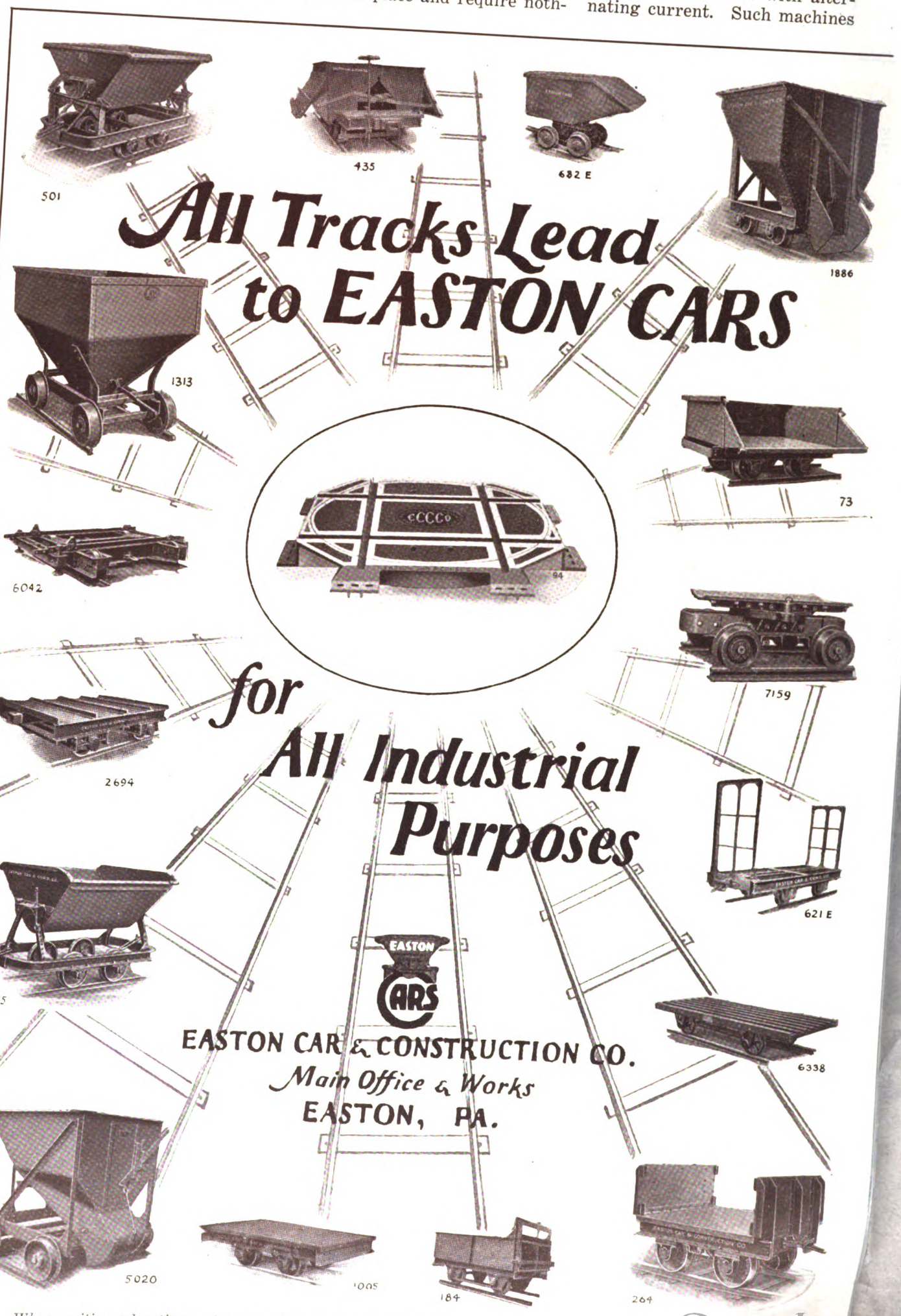
What has been described as the pioneer job in the welding of new construction was carried out in connection with the celebrated Catskill Aqueduct, which supplies a large part of the water for New York City. Far up in the State and on the west side of the Hudson River, the aqueduct crosses the Rondout Valley. The concrete tunnel lining had failed under test. It was proposed to use a certain type of circular reinforcement in meeting the situation. But how were the big steel rings to be gotten into the tunnel and put in place? The solution of this problem was materially facilitated by the arc process of welding. The rings were cut up into three sections each and later on welded together again. In this way, the work was successfully carried out. To join these rings by bolting or riveting was out of the question as far as tightness, strength and permanence of joint were concerned.

Just as has been the case with the oxy-acetylene process, the arc welding system has proved of great value in connection with *putting on metal*. An illustration of this kind of work will give us an idea of its usefulness. On ships, the hawse pipes through which the anchor chains pass suffer excessively from abrasion. Under the circumstances prevailing only a few years ago, frequent renewals had to be carried out. Now, it is possible to effect repairs with arc welding. The operator uses his arc to build up the worn places in the hawse pipe and thus restore the original contour.

An example of the use of the metal electrode in connection with *vertical welding* is afforded by the case of a cylinder belonging to a marine engine. It was one of two vertical cylinders and had been severely scored by the up and down movement of the piston. Only a partial dismantling was required in order to enable the restoration of this cylinder by means of arc welding. Twenty-six places were repaired in the one cylinder.

The tightness of the joints made by the fusion system is one of the most valuable features. In illustration of this matter in connection with arc welding, I may cite the case where it was proposed to use an old tank bottom as the head of a fuel oil tank. The old piece contained a lot of perforations—168 rivet holes, 8 pipe holes, 1 hand-hole and 1 man-hole. These were all filled and the head secured to the tank. We have here a splendid instance of filling in, welding in plate, and welding up the main seam. In fact, the various rings of this storage tank were welded together from the inside.

There are on the market a number of portable outfits. These may be moved about from place to place and require nothing additional except a convenient source of current. Or, the portable outfit may include the means of generating the current. Thus, it may have on board the truck a gasoline engine connected up to drive a dynamo and thus produce its own current. One or more of these portable outfits may be used with alternating current. Such machines



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as these portable affairs make it possible to go to the job and thus do a good deal of work more conveniently than would otherwise be the case.

There is an advantage that is claimed for the alternating arc that may find a place here. According to one manufacturer, the direct-current arcs make welds that are either electro-positive or else electro-negative. "In either case, there is a liability of a voltage couple being formed with consequent electrolytic corrosion, especially in damp places." The claim is to the effect that this situation is avoided when the alternating-current arc is employed.

Where direct-current equipment is to be used and only alternating current is conveniently available, the problem may be solved by employing a motor-generator set. That is, the alternating current operates a dynamo which in turn generates direct current.

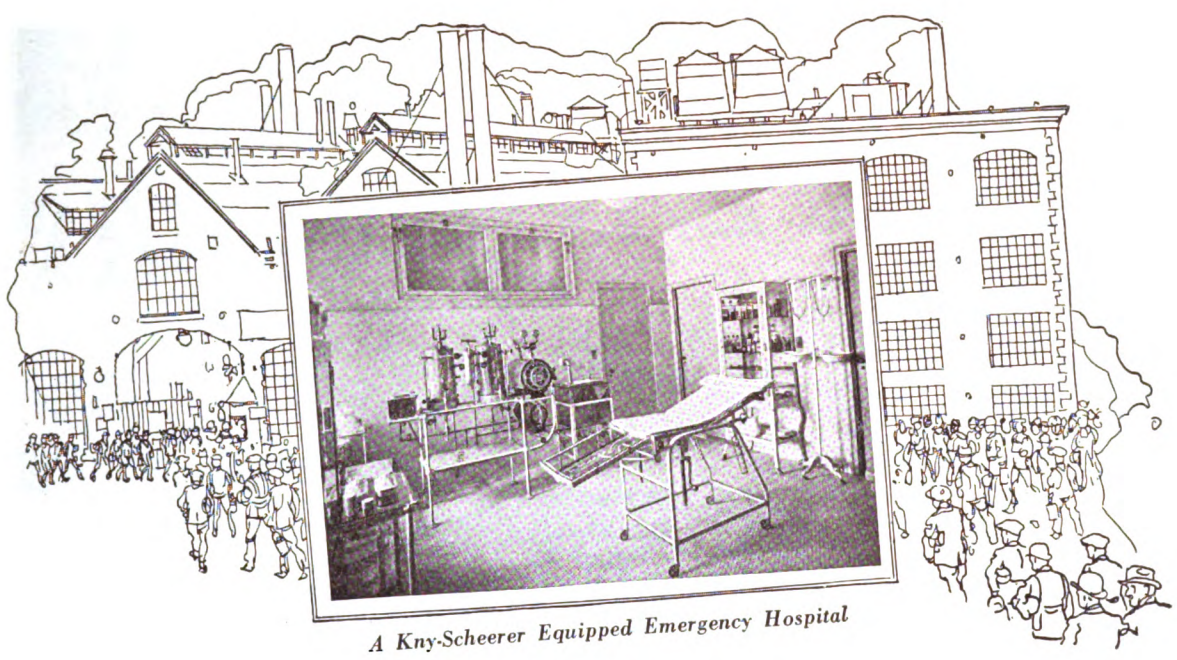
The concern making portable, alternating-current outfits regards bare electrodes as rather obsolete and gives its preference to coated ones. These people also claim that cast iron may be deposited from a suitable electrode.

I shall not have space to go into this matter in much detail. Resistance welding is largely confined to manufacturing operations. Machines are employed to perform certain classes of work and these are operated in the performance over and over again of essentially the same thing.

The *spot welding machine* may be mentioned as a type that is largely used. In illustration of the work performed may be cited the manufacture of mowing machine cutter bars. These are long affairs with triangular cutting pieces. Forty-one spots are welded per bar. Some at least of these spot welds involve three thicknesses of metal—two 1/16-inch thicknesses on top of one 3/16-inch thickness. It is understood that 25 such bars may be welded every hour on one of the recent machines.

Butt-welding machines are used to effect the welding of joints where there is a continuous contact area between two surfaces pressed together at the moment of welding. One machine of this type deals with small welds, the area of contact being specified as limited to a maximum of 0.4 square inch, the maximum thickness of pieces to be ½ inch. A square rod, 0.6 x 0.6 in cross-section, which is to be united end to end with another rod of the same size and form, would call for a butt-joint of a size within the capacity of this machine. The production possible may vary from 35 to 85 welds per hour. Another butt-welding machine is designed for operation upon iron or steel wire of a size varying from No. 16 to No. 8 (B. & S.) on separate pieces or hoops over 8 inches in diameter; or to No. 12 on smaller hoops, rings or buckles. The production possible with this machine may be stated as 800 to 1,000 small separate pieces per hour—buckles and rings. If the pieces are long and separate, the production is reduced to 500 or 600 per hour.

Still another butt-welding machine has a capacity which may be stated thus: Pipe joints may be made of sizes running from 2-inch diameter to 8-inch diameter. This machine operates on iron or steel. The work may consist of many other things besides pipe joints. Thus,



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Just two points of this many angled subject, but both are well worth a second reading.

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may be the thing in contemplation. If so, the capacity of the machine varies from rims 6 x ¼ inches up to rims 18 x ¾ inches. From 30 to 100 rims may be welded up per hour, the exact number varying with the size and condition.

On these butt-welding machines of this and similar types, a good deal of pressure is required. In the present case, 30 tons standard pressure is exerted upon the metal at the joint by means of two 15-ton cylinder jacks operated from an accumulator outside the machine, this accumulator having a capacity of 1,200 pounds per square inch. The jacks may be operated with oil or water, but preferably with oil.

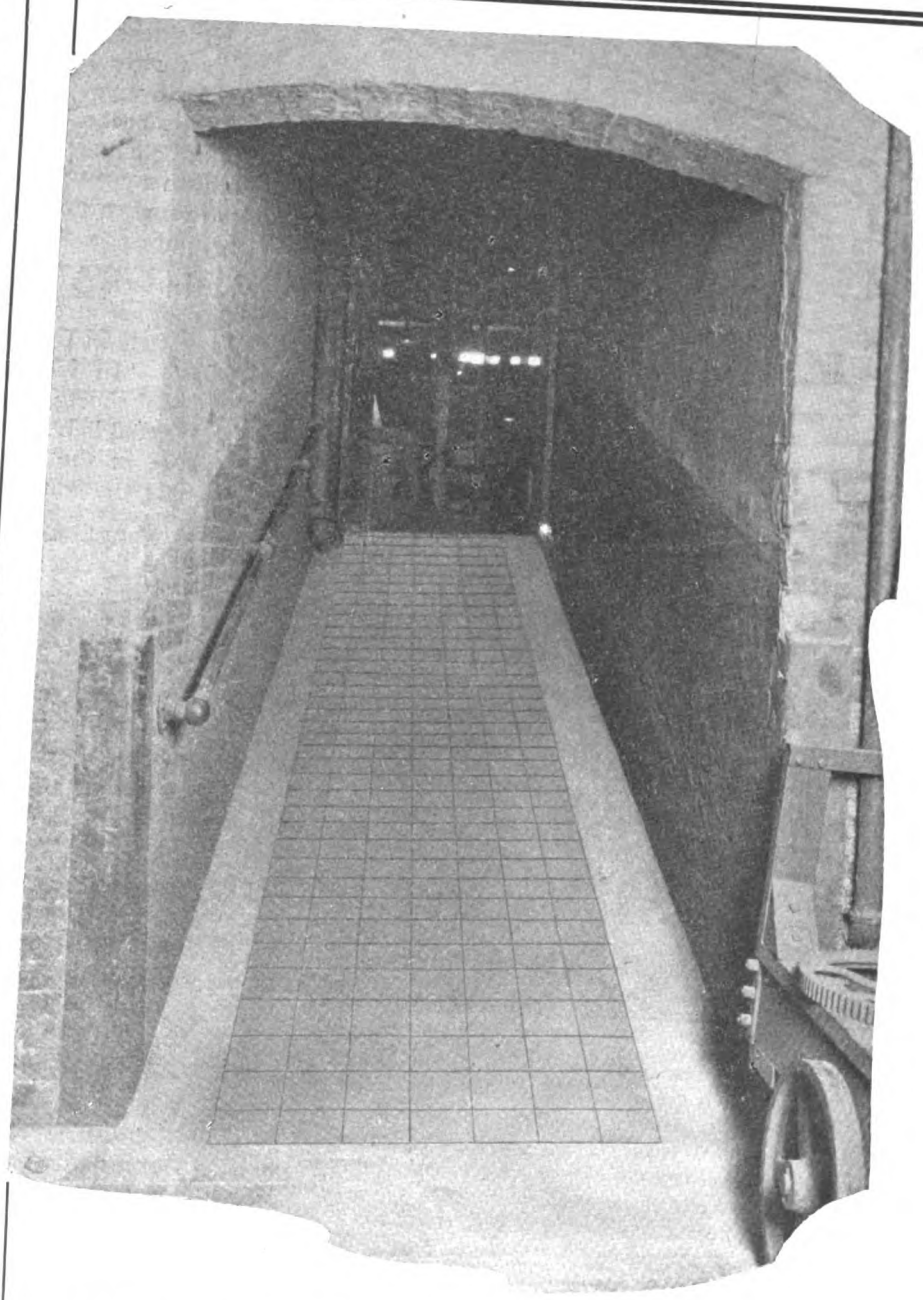
Take another butt-welding machine. This apparatus is capable of handling steel boiler tubes from the 1½-inch size to the 4½-inch. On this machine, most of the 5-inch super-heater tubes may be welded if the sections are reduced at the location of the weld. From 35 to 60 welds may be made per hour, the operation including a rolling down of the butt after welding.

The *seam welding machine* is still another piece of apparatus dependent upon resistance welding. With a representative machine, pressure is exerted on the roller by a series of springs located on each side. It will be seen then that for the class of work handled by this device the matter of pressure does not assume formidable proportions. The thickness of the stock is limited at the maximum end to No. 20 gage (B. & S.), and the length of the seam to 24 inches. Brass and zinc sheets may also be welded on this machine, the maximum gage being No. 24. The production accomplishable depends upon the length of the seam and also upon the adaptability of the jig. However, 30 seams may be taken as the minimum per hour and 120 as the maximum.

A seam welding machine built by another concern is said to handle seams of 4 to 5 feet per minute when the gage thickness ranges between No. 16 and No.). Such a machine may be sed in running seams in pails, hite lead containers, lard coniners, grease pails, and the e.

A far western concern has ought out a spot welding maine having a capacity for a le range of work. It seems t what was sought, at first, was a machine capable of meeting the severe requirements of manufacturers of metal cabinets, boxes and the like. It was desired to weld in corners inaccessible to the ordinary machine. But, apparently, they have pushed the matter further and produced a spot welding apparatus capable of dealing with pretty much all descriptions of work. In short, they regard this machine as a universal apparatus. The cycle of possible adjustments is so large that the machine may be set for particular work of many kinds and thus used as a special machine on each of the several classes. Naturally, the machine may be used now for this job, now for that.

Spot welding is not to be regarded as a method of uniting metals that has but limited application. This is not the case. Many of the metal products of today would have to be made in an entirely different way, without the electric spot welding process, and the increased cost in time, money and material would render their manufacture unprofitable.



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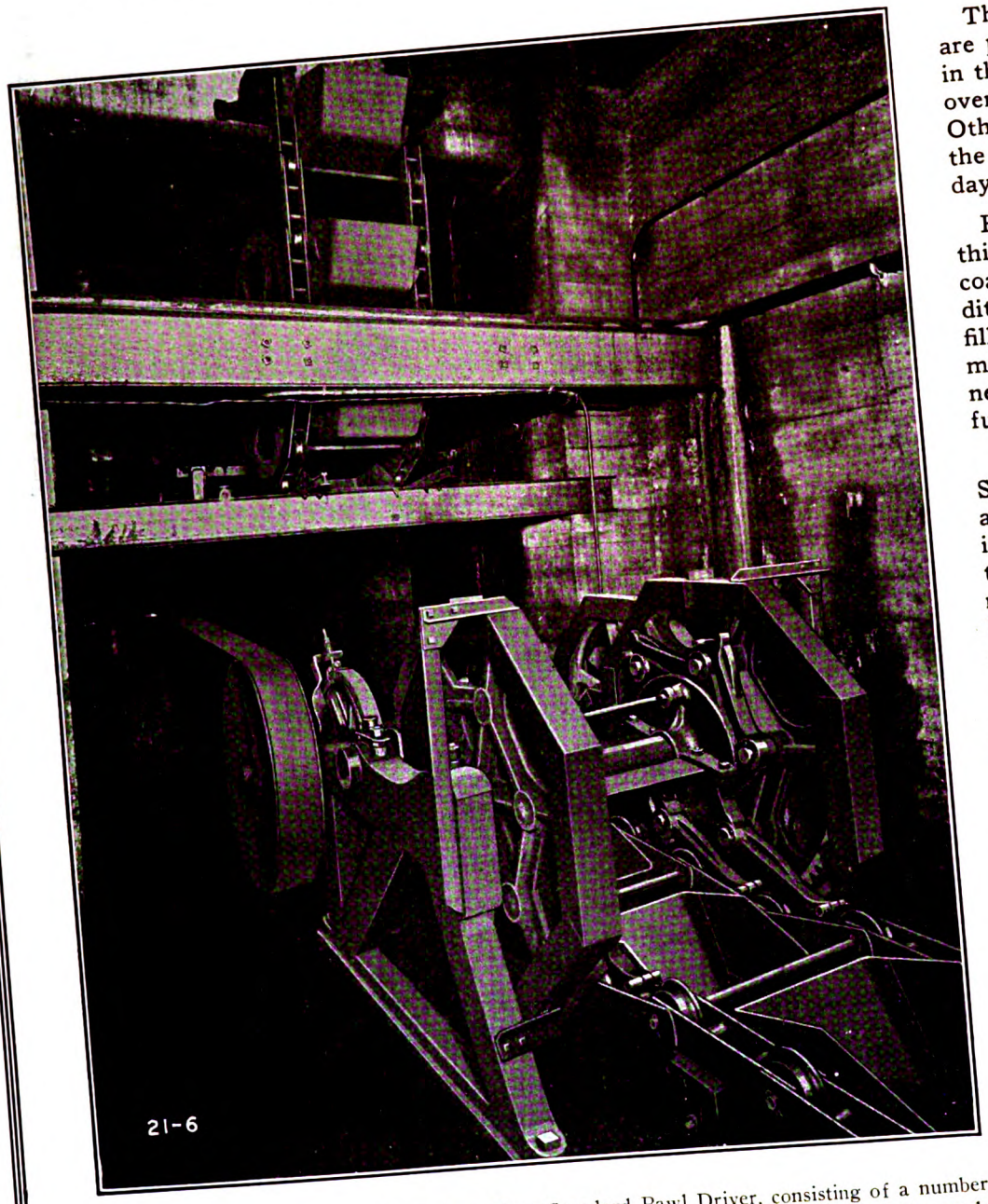
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The thrifty squirrel in the Fall, when nuts are plentiful, stores away his savings in holes in the ground and in hollow trees, to tide him over the Winter, when provisions are scarce. Other animals live on the fat of the land while the living is good, with no thought of the lean days to come.

Business executives can take a lesson from this thrifty little quadruped in the matter of coal storage. When coal is plentiful and conditions are advantageous, bunkers should be filled to capacity. Dependence on the hand-to-mouth method in providing only for present needs, with possibly a small reserve, is doubtful policy.

Mutterings of another coal strike in the Spring are already heard. Yet,—to quote from an article in Industrial Management, February issue,—"In face of reports of another Winter coal shortage, production records show that more coal is being mined and shipped than ever before in the history of the industry, except during the war and immediately after."

It would be a wise plan to emulate the example of the farsighted little squirrel and make provision now against the days of shortage.

Hunt Cost-Cutting Equipment has for over half a century been instrumental in forestalling coal shortage by reason of its facility and adaptability in storing and rehandling coal; thus permitting a wider range of temporary storage spaces as well as the regular bunkers. Ashes are handled with equal facility.

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(*Continued from page* 13)

anticipated to take place in that locality.

Naturally, the first development beyond the old-time factory dormitory was the company town. The chief characteristic of these company towns was their uniformity. The possibilities of architectural and town planning seemed either not to have been known or to have been neglected.

Textile manufacturing is not hampered by the handicaps which surround such enterprises as mining, which must locate where raw materials are found and are always faced by the possibility of exhaustion of the supply and cannot afford to establish anything other than a temporary community.

One manufacturing concern after another has found that after spending considerable money in bringing employees from other cities, the majority have not stayed because they could not find suitable homes in which to live.

Shawsheen Village owes its existence to the enterprise and public spirit of William M. Wood, president of the American Woolen Company, who started the construction of homes here in 1918 to relieve the war-time housing shortage which seriously affected employees of the corporation. Mr. Wood was thoroughly familiar with the various stages of housing which had prevailed in New England, from the dormitory stage, through the hamlet of buildings all alike adjoining the factory, to the development of independent communities.

He had become convinced that proper housing makes working men happier and more contented, and reduces absences due to sickness—that it makes workers much more efficient and reduces the number of floaters. He knew from experience that proper housing has helped to avoid strikes — that it has increased the number of individuals and organizations taking an interest in the betterment of social conditions. He had become convinced that the houses must not be located in the shadow of a great factory. Too close proximity to the work makes the employee feel that he is living under the scrutiny of his employers and that even his home is part of a big machine or industry. This restraint naturally makes him restless.

A Challenge to Main Street

There is more incentive to buy property that is part of a general community than where houses are too close to the factory. Becoming part of a general community develops a permanent class of labor.

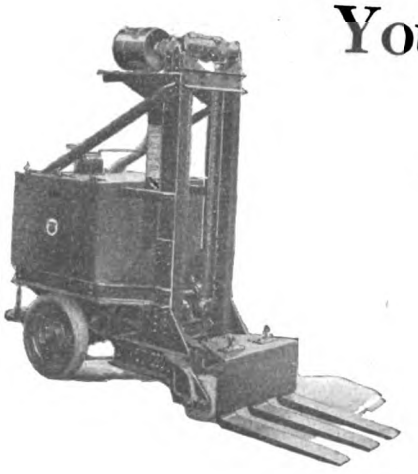
While employees will welcome arrangements whereby, through wholesale buying, building materials and effective erection costs have been reduced, and these reduced costs made available to employees, they will oppose as a repulsive arrangement any plan which puts housing on a charity basis.

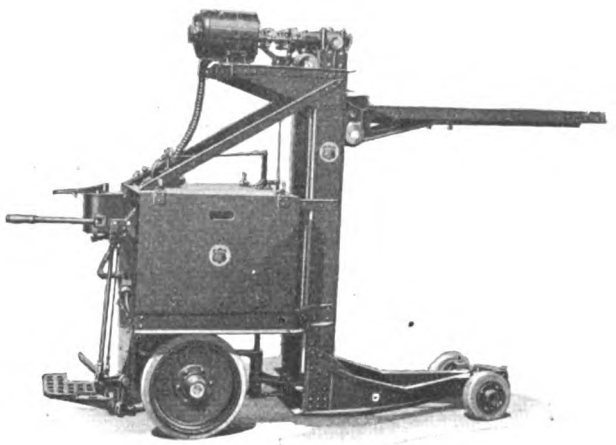
To bid for labor in the open market solely on the basis of wages, tends to a disorganization of the labor market, and if continued long, ends in an industrial conflict.

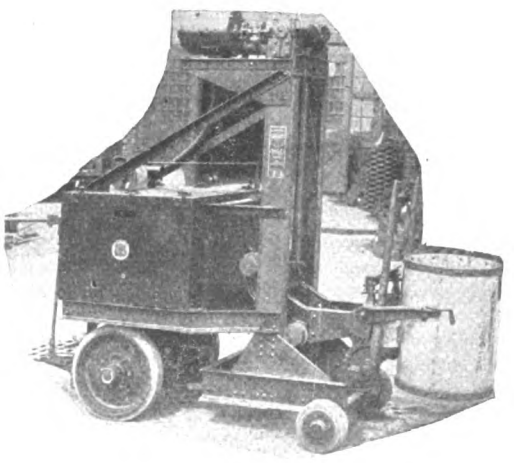
Eligible real estate companies do not as a rule consider the building of working men's houses a profitable enough in-

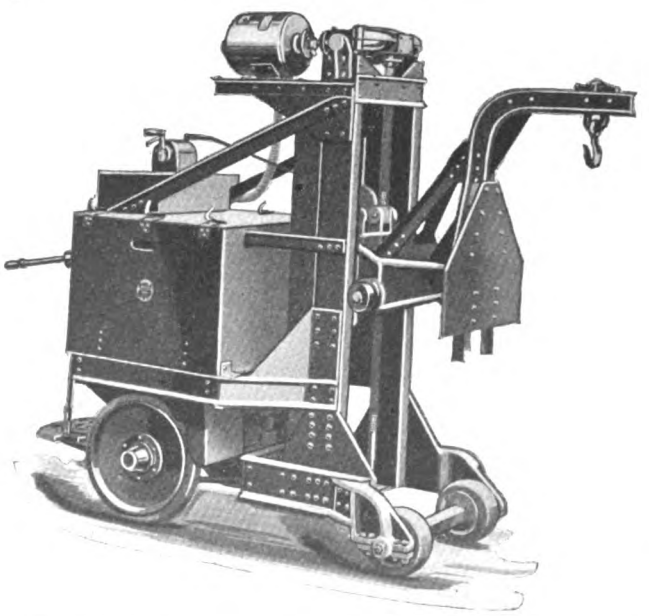
The Latest "Tier Lift" Principle?

You Will Always Find It on a LAKEWOOD









From the first "Tier-Lift" Truck built, the name LAKEWOOD has always been associated with the last word in "Tier-Lift" development.

Here are a few of the many types of Lakewood Trucks in use. Each one has meant the solution to lower costs in lifting and carrying problems. If you don't find a type exactly suited to your requirement after looking through our catalog, our engineers will design one for you. The chances are, however, that one of the "Lakewood" Trucks will solve the problem for you.

We shall be glad to assist you in making a material handling layout of your plant and recommend the equipment you need.

Writing involves no obligation.

The Lakewood Engineering Co.

Cleveland, Ohio

Originators and Patentees of the "Tier-Lift"

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vestment to interest them. This leaves the field open for speculators and exploiters who either build a flimsy house to sell at the price of a substantial one, or promote a selling scheme on a bleeding basis.

Industry should, as far as possible, aid the working man to receive as much as possible out of the wages he works for, which is another way of increasing wages.

Mr. Wood saw in the fields and meadows bordering the "Lazy Shawsheen" an ideal setting for a modern and model town, and as a result of his vision Shawsheen Village today is the outstanding real estate development of the decade and one of the most unique as well as one of the most beautiful villages of the Commonwealth.

Starting with a crossroads town of a few houses which clustered about a small mill, the director of this enterprise planned to create a typical New England community, sufficient unto itself in business and recreation facilities and every other adjunct necessary for the comfort and happiness of its residents.

There was immediate need of houses, however, and once a general plan was adopted, construction of several was commenced on sites that would later fit into a harmonious scheme. But in the need for haste these early houses were not slighted in architectural detail but all were built along attractive colonial lines and are today, in fact, among the most pleasing in the whole community.

Great elms were a feature of the original village and one of the first steps in the general scheme was the moving of these great trees to selected locations, and so well was this done that they are today thriving in various corners and settings where they do much to remove the rawness usually associated with such development.

The old mill was torn down and the few houses around it moved some distance from the crossroads square, which was made the central feature of the new community. Along the Shawsheen River, a small, attractive, swift-running stream which was bordered by some marshy fields, rough field-stone walls were constructed, adding greatly to its charm while increasing its flowage, and the marshes then drained, filled and brought up to grade. When this preliminary work was finished an organization was perfected to carry on the project, a group of men, all employees of the corporation selected by the president, who caught from contact with him something of his ideals and his ability to accomplish things in the face of many obstacles.

In the spring of 1919 work was commenced in earnest and to hundreds of artisans and laborers Shawsheen Village was the one bright spot in a section seriously affected by the post-war depression of that year. Sewers, gas lines, telephone and electric light service wires disappeared underground by the mile, roads were staked, macadamized, houses sprang up almost over night, trim cement-and-brick structures replaced the old mill, and a building to house the Post Office, the Shawsheen Market and several offices was started.

The organization that Mr. Wood had built functioned remarkably well. A wooden [illegible] plant was installed to [illegible] interior finish, doors,



BANKER CONSULTING ENGINEER PRESIDENT PRODUCTION MANAGER

The Dividend — found — in the chimney

Banker: "Underwrite an issue of $500,000 preferred stock on the earnings you show? Never! And that's final."

President: "But our production manager can prove that the increased production will double the margin of safety on the preferred dividend. The new money makes it poss . . ."

Banker: "A banker is neither a speculator nor a promoter. Increased earnings, greater output, estimated sales, new business—everything is *dependent* on the new money. You don't seem to understand that you need larger net earnings by $35,000, or that amount saved in operating costs, to make this new capital issue sound."

At this moment the Production Manager entered accompanied by a famous Consulting Engineer. Everybody rose. "Here's the doctor!" began the Production Manager, "the chap who stayed up all last night looking for a serum to counteract high operating costs in this plant. And he found it."

Banker (scathingly): "And what is this wonderful serum, and just what has it got to do with this stock issue?"

Consulting Engineer: "The serum is just a little hot water and it has got everything to do with this stock issue. Isn't $40,000 saved equal to half a million increase in sales? The heat for the whole plant will be turned into net earnings—$40,000 a year. Grinnell Company engineers find the hot water heating system can be run from the waste heat from your enamelling ovens, thus doing away with three boilers."

President: "I can't believe there's any such waste. Our workmen have never complained of excessive temperatures."

Production Manager: "No, because the tremendous heat from those ovens has an ample vent through the chimney."

President: "I understand now. Why did we never think of that before?" (Turning to Banker) "Do you see what that means?"

Banker: "Yes, $40,000 a year saving is 8% on the preferred stock issue, but—"

President: "More than that: now that we don't need those three boilers for heating, we are free to dispose of the power plant altogether. We can buy electric power cheaper than we can generate it, as I told you."

Banker: "The power plant for sale! I'll bid $100,000 for it. You didn't know that the adjoining property was bought yesterday by the new forge works in which I am interested. Our plans call for a power plant and $100,000 would make a neat little capital reserve for your company."

President: "Sold!"

Banker: "$40,000 a year saving, cheaper power, $500,000 new money and interest on a $100,000 plant. Well, well, that ought to insure a common stock dividend next year."

President: "Say, gentlemen, do you realize the dividend which has been slipping up that chimney all these years?"

Consulting Engineer: "With the specialized engineering on hot water heating system that Grinnell Company furnishes, I'd almost guarantee to find the same sort of dividends in half the factory chimneys of the city."

Where the Facts Came From

Right now Grinnell Company is figuring with a large Chicago firm where harnessing the waste heat of their great enamelling furnaces will heat the whole plant. Practically, therefore, all their present heating expense is saved. Putting it another way, heating will cost them exactly nothing. Except for the financial matters mentioned in the ad the case is quite similar—a saving of $40,000 a year. The booklet, "Five Factors in Heating Cost," will be sent to anyone interested in heating industrial buildings. Send for your copy today. Address Grinnell Company, Inc., 307 W. Exchange Street, Providence, R. I.

GRINNELL COMPANY

Automatic Sprinkler Systems | Steam & Hot Water Heating Equipment | Humidifying and Drying Equipment | Fittings, Hangers and Valves | Pipe Bending, Welding, etc. | Power and Process Piping

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sashes, etc., steam shovels simplified the roadmaking and the numerous fills which were necessary and, thanks to the organizing power, supplies of material moved into the village and were erected as if by clock work.

And the same rate of progress has continued up to this writing. Today we find at Shawsheen Village hundreds of houses of brick, wood, stucco and stone, all attractive, livable and varied in design, street after street lined with comfortable homes set in well kept lawns, a Village Inn with accommodations for forty guests and a dining room seating 200 persons, two garages, a laundry, a railroad station, a beautiful drug store and Spa building, two office buildings and a third being constructed, a central heating plant for the public buildings, a huge athletic field with a quarter mile cinder track which is flooded in the winter, a swimming pool, tennis courts, a bowling green, a dance pavilion, convenient stores where local tradesmen supply the wants of the community, even a community watering cart to flush the streets. The list is endless and space does not permit an adequate description of this remarkable community.

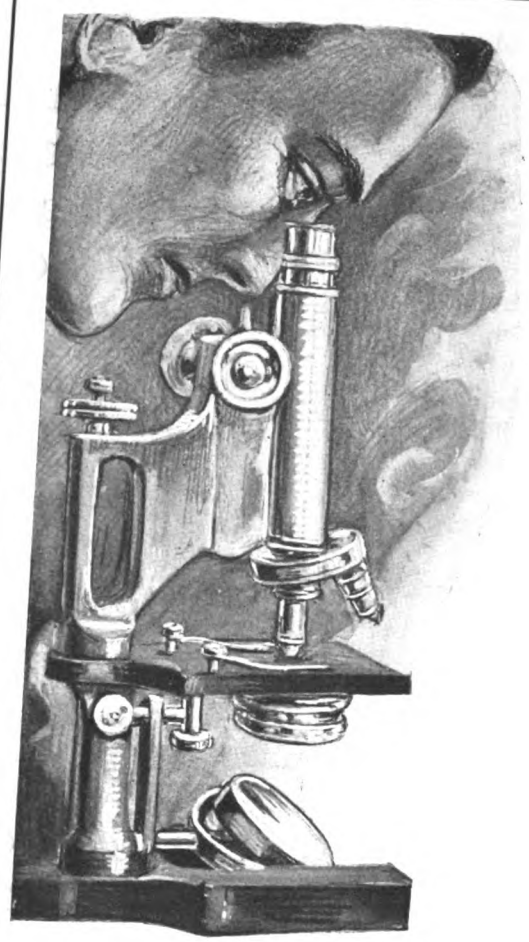
But anyone driving through Shawsheen Village cannot fail to appreciate its charm. It has not only been rapidly and efficiently built but it has been beautified as it developed. It is not new and raw, for it appears even in its unfinished state settled and substantial and permanent. Its business buildings are not too business-like to appear out of place in the country, the houses blend into the landscape, the great trees, the hospitable seats along the broad cement walks, the beauty of the occasional vista, all are in keeping.

Shawsheen Village is contented and prosperous, steadily growing and achieving, providing an ideal location both to employees of the American Woolen Company and others desiring to make this modern and model community their home, and perhaps the most interesting fact is that Mr. Wood's vision has materialized successfully rather than meeting the fate of so many other Utopian dreams of community development.

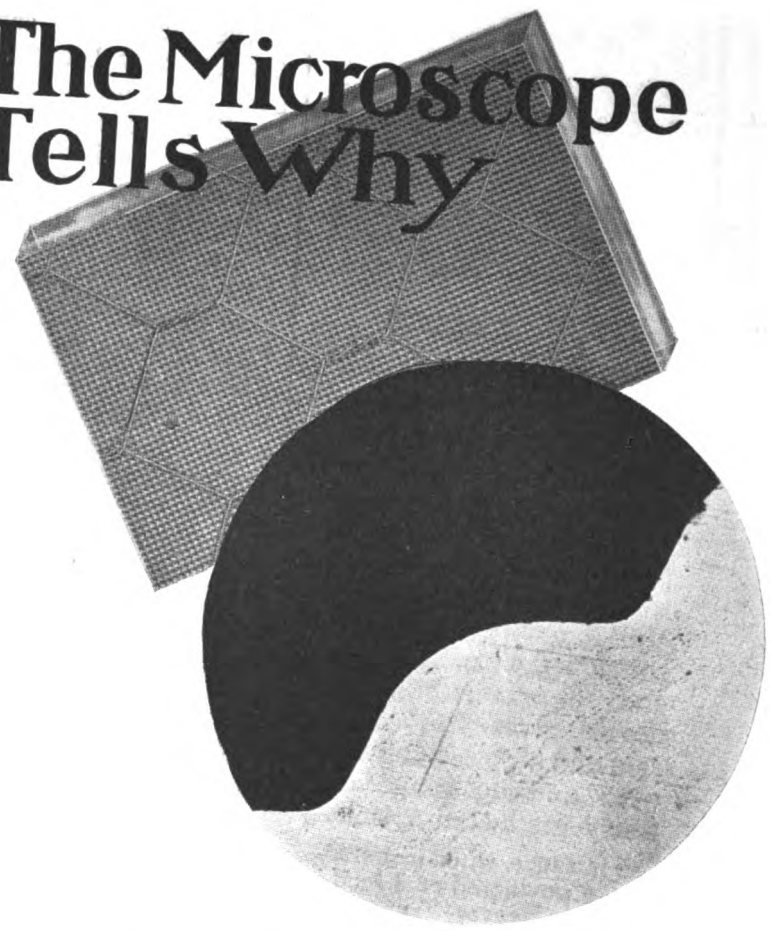
I made inquiries among the people living in the community, as well as among officials of the Woolen Company, as to whether it required any artificial stimulus or assistance from the company to interest the members of the community in civic and recreational activities. My answers were all alike and to the effect that the members of the community immediately and without any artificial stimulus whatever, voluntarily took up active participation in the proper organization and supervision of the educational, civic, and recreational activities.

Shawsheen Village is a successful accomplishment which may well be the model for thousands of other American communities which will replace the slovenly and disorganized hamlets which house the workers of many a great industry. It has been a success from every standpoint, including that of adequate financial return from the investment.

A representative of the Personnel Department of the Company says: "We first thought that the services of the department might be necessary in this connection, and in fact, laid an outline that we thought it would be wise to follow, but we found



The Microscope Tells Why



FACTROLITE

Diffuses Daylight

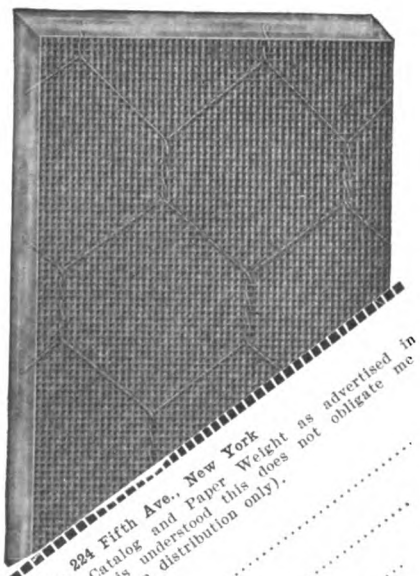
Each little pyramid has **plane** sides but a rounded apex, and a rounded fillet between rows.

FACTROLITE is scientifically designed to prevent direct reflection of daylight, even when the light strikes at a narrow angle of incidence to the panes.

At the same time the maximum degree of **diffusion** is attained. Large and small industrial plants have used thousands of feet of this improved daylighting glass.

At a time when conservation of resources is a paramount need, why not consider the conservation of daylight?

A sample of FACTROLITE sent on request to any engineer. Simply fill out and mail the attached coupon.



The Mississippi Wire Glass Co.

224 Fifth Avenue, New York

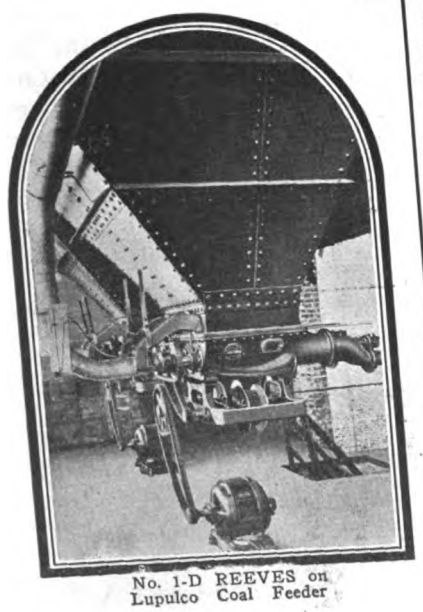
CHICAGO ST. LOUIS

Mississippi Wire Glass Co., 224 Fifth Ave., New York
Gentlemen: Send me a Catalog and Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way. (For American distribution only).

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No. 1-D REEVES on Lupulco Coal Feeder

Accurate Speed Control Wherever You Need It!

SLOW speed, fast speed, or any speed in between, is made possible on any machine through The Reeves Variable Speed Transmission. This inexpensive, durable, efficient device gives you accurate and absolute control over a wide range of finely graduated speeds.

For instance, when installed with a powdered coal feeder, The Reeves Transmission enables you to regulate the speed of the feeder according to the grade of coal and the heat units contained, thus saving in coal consumption and giving much better combustion.

The uses of The Reeves Variable Speed Transmission are as varied as the needs for accurate variable speed control. Made in sixteen sizes, covering requirements from 1 to 150 H.P., it gives ranges of exact speed variation from 2 to 1, up to 16 to 1 ratio. Undoubtedly, The Reeves Transmission can fill an important need in your business. Write for catalog today.

"The Reeves" Variable Speed Transmission

Write for Catalog, T-44

REEVES PULLEY CO.
COLUMBUS, INDIANA

when the houses began to fill up that no direction or encouragement of any sort was necessary since there seemed to be a natural call and need for community organizations from the people living here and several that were formed some two years ago are in a very flourishing condition today."

The center of the community affairs is a body known as The Shawsheen Village Civic Association to which every resident of the village upon coming here automatically becomes a member, and their activities are handled through several committees. For instance, the Welfare Division acts as a sort of reception committee to new residents, makes them acquainted with all the families, and takes care of informing them of the facilities that the village offers. There is an Athletic Committee which manages tennis tournaments, field days, etc., among the residents. There is a committee that handles Boy Scout and Girl Scout matters, one for civic affairs and another that plans and carries out entertainments, and still another that interests itself in school affairs.

There has also been formed a Women's Club, which now numbers about 200 members; a Boys' Club and a separate Athletic Association for the encouragement of sports, which handles all competitions with outside teams; an organization which maintains and manages a bowling green; and numerous other small groups of people interested in one particular thing, such as music, radio, etc.

All these are the result not of the activity or suggestion of any personnel department, but came into being because the residents of the village felt a need for them.

The Post Office Department, or, in the final analysis, the taxpayer, pays an annual toll amounting, in round numbers, to $1,740,000 for the careless addressing of mail matter; the depositing of letters and packages with incomplete, inadequate or incorrect addresses, an overwhelming majority of which comes from large patrons of the mails.

In another effort to stem the tide of this waste. Postmaster General New has designated the week of February 18 to 25 as *Better Mailing Week.*

What can you do for *me*?

Your equipment is individual—your methods are individual—your needs are individual. And when you need conveyor belts you want conveyor belts that will do the best work on your installations. You want a scientific and intelligent study of your equipment needs.

That is precisely what Goodrich supplies. Goodrich conveyor belt recommendations are always governed by *individual* working conditions. A Goodrich engineer will study your installation and recommend the belt you need.

We will be pleased to have you consult us for a solution of your conveyor problems.

THE B. F. GOODRICH RUBBER CO.
Akron, Ohio

Goodrich
"LONGLIFE" Conveyor Belts
"Best in the Long Run"

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Patriarchal Versus Modern Shop Management

(*Continued from page* 17)

in the departments where "training on the job" has been active.

When the Willys-Overland Company of Toledo, Ohio, found it necessary, due to increasing orders, to put on more help, and increase the number of employees from 7,000 to 13,000 in three months, it was obvious that a large part of the 6,000 new men would have to be quickly trained and inducted into the various automotive activities of that large plant.

An expert training engineer was secured and a small organization formed, which knew how to train and rapidly develop men and women to carry on the numerous operations which go to make up the automobile business. And "training on the job" was started. Separate training sections were quickly planned and installed, instructors selected, equipment and tools found, and the work of "training on the job" was under way. In a remarkably short space of time twenty-five—fifty—then seventy-five of these training sections were planted throughout the various shop departments, and the training hives commenced to turn out men and women thoroughly trained and grounded in the jobs they had started only a short time ago to learn.

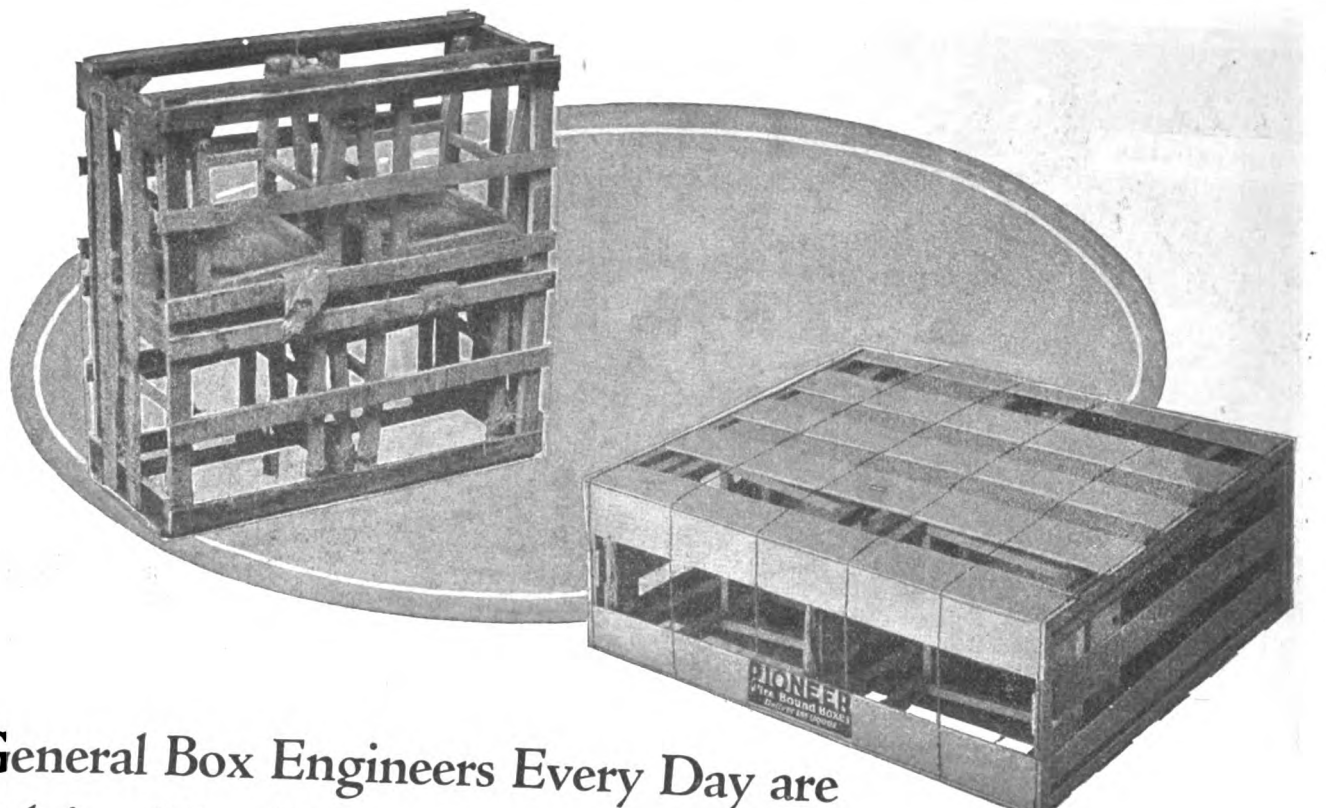
The progress made was amazing. Superintendents and foremen who, previous to the installation of these training sections into their departments, had thought themselves "lost" on the labor problem, were soon put at ease when they discovered how quickly the training organization supplied them with a satisfactory type of men and women who would at the outset produce as much and as well as the so-called old hands.

This had a stimulating effect upon the old hands, as they clearly saw that the newcomers were rapidly becoming prepared to take bench or machine, in order that production might go on uninterrupted, in event that they should show a dissatisfaction or neglect to perform as they ought.

At first, some may think this not to be a good condition for the old workers; but if they will reflect a moment, it will become obvious that the average worker needs stimulus of some sort brought to bear which will cause him to steady down and get the best out of his work, instead of roaming around, shopping for "greener grass" or better conditions, which very seldom exist.

When a real opportunity comes, a man will recognize it, and in all probability he will accept the promotion, but there is nothing gained for either the worker or the concern he is leaving, if his leaving makes one more "roamer" in the industrial world.

Manufacturers are now giving much thought to the importance of properly "fathering" the newcomers who are hired to learn; also the man who claims to be this or that, but upon his being put to the task, it is discovered by both the man and the boss, that he is woefully lacking in the experience necessary to the peculiar work in that particular shop, although he has



General Box Engineers Every Day are
Solving New Boxing and Crating Problems

A furniture manufacturer became interested in General Box Engineering Service. He invited our co-operation.

Above is shown the crate he has been using and the Pioneer Wirebound Crate designed in our laboratory. Following is the story of the economies effected by the new crate.

Cuts Cost in Many Ways

The Pioneer Crate saves money in many ways. It is 15 pounds lighter—cutting transportation costs. It offers better protection to the chairs, reducing damage claims.

We deliver Pioneers three-fourths assembled—cutting the cost of building crates more than one-half. They can be packed more easily and closed in a fraction of the time previously required.

Unpacking is simplified. Clip the wires with an ordinary wire cutter—a matter of seconds. The entire top opens up like the lid of a trunk. One chair can be lifted out, if desired, and the others remain in the crate until needed. Naturally this manufacturer's customers like to receive shipments in Pioneers because they simplify uncrating and storing—and deliver the goods undamaged.

This Service is Available to You

Every day General Box Engineers are developing better and more economical boxes and crates for shippers. It is possible they can help you. It will cost you nothing to find out. Merely write us that you would like to have a General Box Engineer call on you. He will do so as soon as possible.

A copy of "General Box Service" will be sent to anyone interested in the subject of better boxing and crating. Ask for it.

GENERAL BOX COMPANY

508 North Dearborn Street, Chicago, Illinois

SIXTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

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Kansas City, Mo.
Louisville, Ky.
Nashville, Tenn.
New Orleans, La.
Pearl River, La.
Sheboygan, Mass.
Winchendon, Mass.

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worked on a similar job somewhere else.

Here is where, "Training On the Job's" well directed plan comes into importance, as it tests, trains, upgrades and adjusts all labor coming in or going out through its training sections; therefore very few who earnestly desire to work are lost to the plant.

When numerous sections of this form of training are installed in a manufacturing plant, they afford a wide field of fitness for the training of labor as we find it today, and unless men going into its fold are unreasonable, or have some hidden reason for squeezing out of the plant, they can be, and are taken care of and trained on some job for which they are suited, and which also is to their liking.

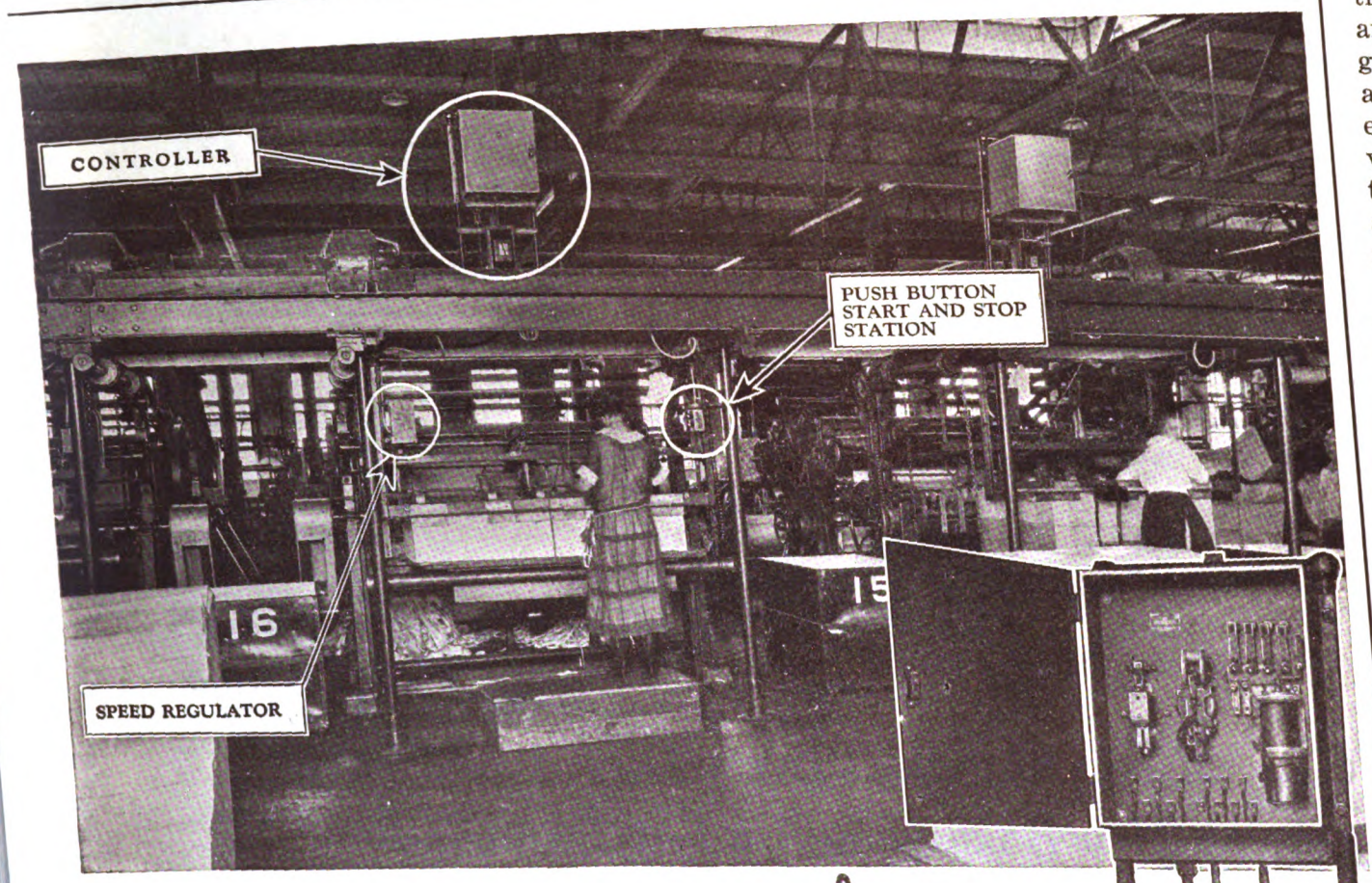
The money factor is by no means the only important one, as after all it does not vary enough in the general field of certain industries to make any material difference. However, the most important thing for us to learn today, is to educate the foremen to keep the help long enough so that they will get that "feel at home" spirit, then the battle is won and the money factor will be found to be only secondary.

During the war, emergency men were in such demand that but little encouragement was needed from their friends to animate them in gathering a few tools together in a hand-bag, and going forth into the industrial world to "break in" to some trade. This method was adopted, and encouraged, because of the great need for men at the time, as well as because of its being easy to get good jobs at high wages; which resulted in the letting down of the bars to anybody and everybody who sought a footing in a trade.

Today there are hundreds, if not thousands of these men that claim to be tradesmen, who are absolutely devoid of the elemental requirements of the craft in which they are working. They have never learned, nor have they had the opportunity to learn the A B C's of the trade they are trying to follow, and manufacturers everywhere are paying out good money for a return which is very questionable as to profit.

For instance, the number of *good* tool-makers is now pitifully small, and they are chiefly of the older generation. As they pass, there are almost none being trained to take their places, resulting in the new method of "Training On the Job" by the intentional method, rather than by the old method of "breaking them in." Thereby men and boys are inducted into our shops and plants and rapidly trained to operate some single-purpose machine or unit for manufacturing, and then supplementing this training by the study of the applied academic work, either by part time study in the shop or by going to one of the night schools set up in most of our large cities.

Moreover, the attitude of the worker toward his job has undergone a decided change, for he expresses it both by word of mouth and by his actions. He is in the shop to get all there is out of it. If good fortune or the current requirements put him in the position of being sought after, his first thought is of the opportunity this gives to "jack up" his wages; not how he can best serve the plant, or best develop himself for the new job. In place of coöperation there has developed a chip-on-the-shoulder

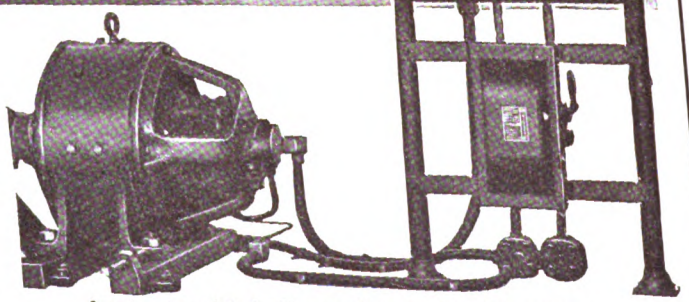


The Right Type of Acceleration Improved Cutter Production

By adopting control equipment designed by C-H engineers, with recommendations from the electrical engineer of the Champion Coated Paper Co., difficulties and delays in the cutter department of this paper mill have been eliminated.

Although individual cutter drive with automatic current limit acceleration used on 15 cutters was a big improvement over line shaft drive, there were a number of objections to current limit acceleration. For perfect control of paper cutting *time limit acceleration* offered the only solution. The smooth even start secured with this type of control permits quick acceleration to full speed of 300 feet per minute without breaking the lightest weight paper, and it eliminates the cutting of the first sheets under length as is the case when cutters are started with a jerk.

The enclosed C-H Automatic Controllers are installed on a gallery above the cutters. A Start and Stop Push Button Station is placed at a convenient point, with a speed regulating rheostat easily reached by the operator's left hand.



Interior view of Cutler-Hammer Constant Time Limit Type Automatic Control Panel—one of 20 used with motor-driven cutters in plant of Champion Coated Paper Co.

Each operator has complete control of starting, speed regulation, and stopping without leaving the platform. The motor always accelerates in a given time, and since the controller carries both Overload and No-Voltage Protection Devices, there is no liability of damage due to excessive current and interruption of the power supply.

The Cutler-Hammer line of motor controllers is the most extensive in the world. Ever since motors began to be used commercially, C-H engineers have been developing starting and controlling equipment. When you call in any C-H sales engineers you are getting the benefit of this long experience.

THE CUTLER-HAMMER MFG. CO.
Motor Control Department
Works: MILWAUKEE *and* NEW YORK
Offices and Agents in Principal Cities
Northern Electric Co., Ltd., Canada

C-H CUTLER-HAMMER AUTOMATIC CONTROLLERS

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spirit subversive of good results.

There is a way out, and that way is through *education*. We all need it. You and I are training constantly and we must continue to seek more light if we expect to hope or keep up near the band in the industrial procession. Most superintendents and foremen are taking up some form of study for self-development, so that they may also keep in the industrial swim. Why then, do we not recognize the fact that the men entering or already employed in our shops also need to be trained?

"But the workers' attitude is different from ours," said a superintendent to me the other day. "We men of more experience know that we have to keep ourselves in training, and also that the workers need to be trained; but the workers do not know that they need to be trained; furthermore through lack of efficiency, they claim that the job is no good and that we are trying to keep them down and in ignorance of how our business is run, when as a matter of fact we want them to get a full knowledge of all our shop methods and processes, that they may become better workmen and more valuable to themselves and the company as time goes on. But somehow we do not get this across to the men, resulting in a serious industrial condition; that of not having more than fifty per cent. of our help 'hitting the ball.'"

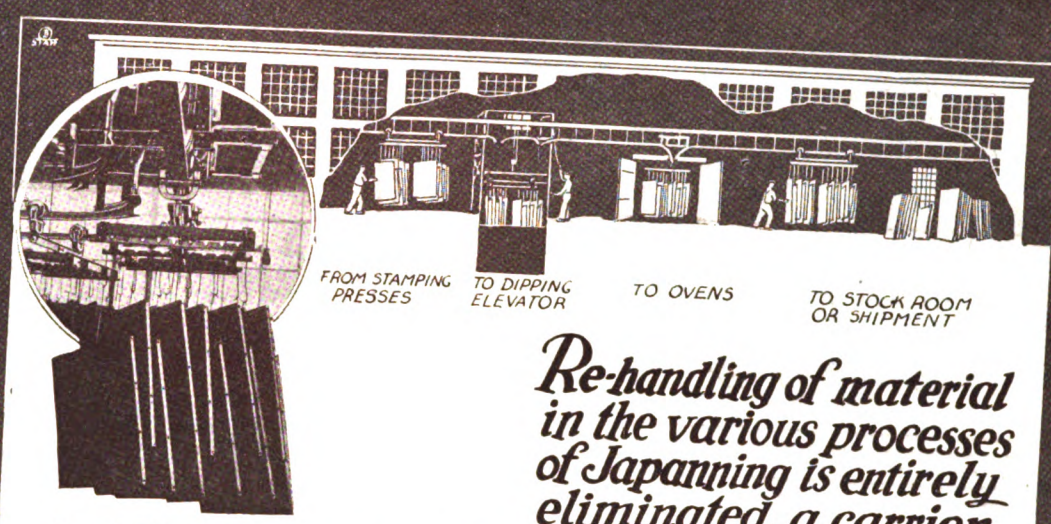
As an example of the value of training service, when the Willys-Overland Co. needed additional help in their press shops, they had to resort to advertising for this new labor; the advertisement read as follows, "Helpers for Press Work." The psychology of that "ad." told the men they were wanted on laboring work and showed them no advancement.

The Training Engineer's attention was called to the results from the advertisement, and found that no men came in, in response to the ad. He suggested that the phraseology be changed to, Assistant Press Operators. The next morning a sufficient number of men came for the job, for this really did suggest exactly what the job was, as the presses for automobile work are very large and it calls for two and sometimes three men to operate them. When the new men started training on the job, they were told that when they demonstrated that they were competent assistants, they would be promoted and re-trained as first string operators with an increase in wage. You see, what was needed most in this shop at the time were good first-class press operators and the assistant job was only a stepping-stone to the real job for which men were very badly needed.

A common error among some of our foremen is that the machine does all the work. Now, however true this may appear, it is erroneous; for the machine without an operative who can get every last ounce of work out of it each hour, is an unprofitable machine unit for both the employee and the employer.

We give lots of thought to the proper selection of the machinery used in the plant, and if perchance it is not performing as it should we immediately get an expert on the job. If the materials or tools do not come up to the mark, we hop right into the trouble, and we keep experts on tap ready to go when called. But the labor—it is usually

(*Continued on page 69*)



Is This Economy?

One sheet metal product manufacturer—using the Cleveland Tramrail—is saving $30,000 each year in labor costs alone—on an investment of less than half that amount.

Besides, he is saving a great amount of floor space, using only one-half as many baking ovens as before, saving expensive heat, and speeding up each operation.

Re-handling of material in the various processes of Japanning is entirely eliminated, a carrier loaded at the stamping presses need not be re-handled until it is unloaded at the finished stock racks.

It is only possible by means of the Cleveland Tramrail.

CLEVELAND TRAMRAIL SYSTEM

HAND-OR-ELECTRIC

It can be adapted to your particular industry.

Carriers will be devised to handle your particular product.

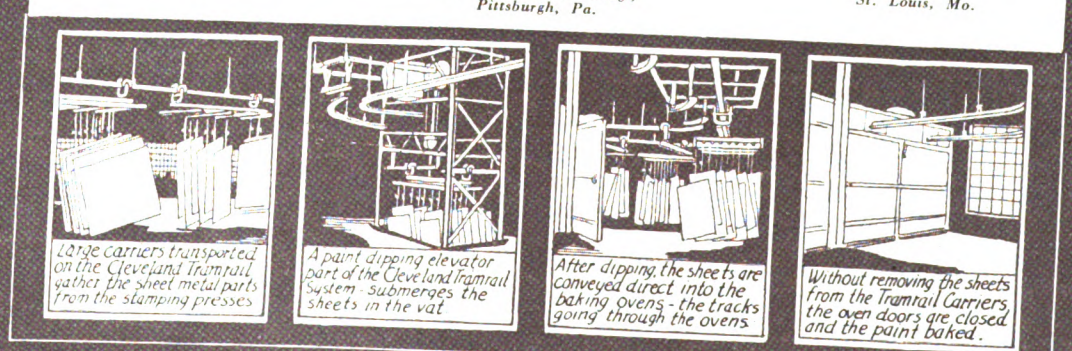
Let's get together and figure a method for greatly reducing your material handling costs.

Our Engineers are at your service. Use them.

CLEVELAND ELECTRIC TRAMRAIL
BUILT BY
THE CLEVELAND CRANE & ENGINEERING CO.
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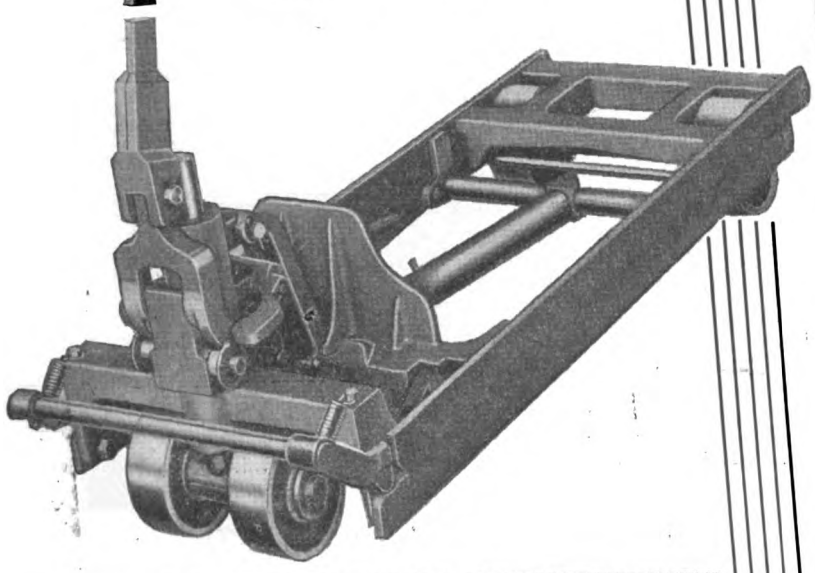
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500 *Arch Street, Pittsburgh, Pa.*
1309 *Pine Street, St. Louis, Mo.*



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NATIONAL ROCKER-LIFT ELEVATING TRUCKS



Like Play To Lift A Ton Load On The ROCKER-LIFT TRUCK!

THE new National Rocker-Lift Elevating Truck raises a ton or more load off the floor so quickly and easily that even a lazy operator has no time to remember that he is working.

Moreover, the operator who braces himself to exert the savage jerk and back breaking strain on the handle that is usually necessary to elevate a ton load on older fashioned lift trucks is destined to feel like the man who reaches up in the dark for the step that does not exist. Nor does he have to make a jack-knife of himself and swoop the handle all the way to the floor—the handle has completed its lift when the end is knee high.

Another decided advantage of the Rocker-Lift Truck is the fact that it may be elevated when the handle is at any desired point between directly front and a full right angle on either side. Think what this means in convenience and speed when narrow aisle work is necessary!

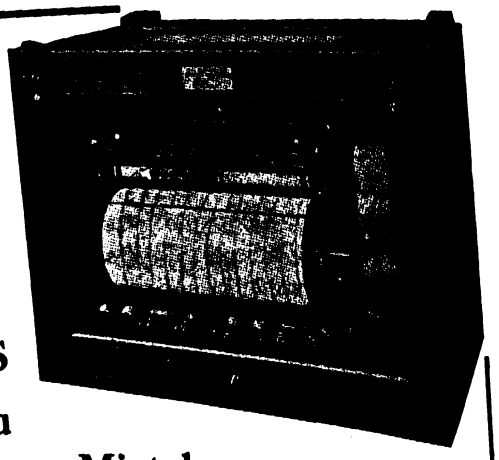
This truck is also built of tested materials and according to designs that our many years of shop-truck manufacturing have shown are best and serviceable under all working conditions. We would like to send you complete information concerning models suitable for your requirements.

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3 BRIDGESIDE AVE. CHICOPEE FALLS, MASS.

Manufacturers

National Counting and Weighing Machines, National Calling System, National "Adjustable" Steel Shelving and National Elevating and Scale-Elevating Trucks.

CAMBRIDGE ELECTRICAL CO_2 RECORDERS and INDICATORS



Will save you Time and Reduce Mistakes

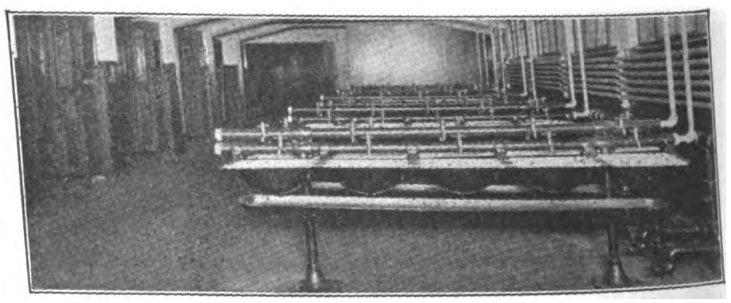
Cambridge Co. Instruments are a cost cutting proposition for any boiler room fully meeting every requirement for accuracy and rapidity of action.

Four Readings On One Chart

Mean a continuous comparative check on four independent units at the same time with less possibility of error in readings. They are entirely electrical—no chemicals to renew—no glass or rubber parts to break or wear out. They can be installed any distance from the flue and still be as accurate as an Orsat.

Made in several arrangements to meet a wide range of requirements. Write for list No. 157-A.

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MEECO INDIVIDUAL SANITARY WASHBOWLS

Were designed especially for factories to provide a sanitary, efficient washing-up apparatus at a moderate cost. They have displaced the open sink, the common trough and other unsanitary methods of washing-up and have been pronounced by many authorities the ideal factory washbowl, whether the plant employs 50 or 5,000 men. They are ruggedly built, simple in construction, easy to install and eliminate high plumbing expense. They are space-savers and take up no more room than common sinks.

A few of the prominent firms who are large users of MEECO Individual Sanitary Washbowls:—Amoskeag Mfg. Co., 1000; Bethlehem Shipbuilding Co. (Fore River Works), 1000; Central of Georgia R. R., 1000; Colt's Patent Fire Arms Mfg. Co., 3200; General Fire Extinguisher Co., 1200; New Departure Mfg. Co., 1600; Pratt & Whitney Co., 2800; Underwood Typewriter Co., 1000; United Shoe Machinery Co., 2400. The complete list of firms using MEECO Washbowls reads like the Blue Book of American business. 5000 companies in 200 lines of business have adopted them as washroom equipment.

They Are Really Sanitary

There is room enough at each bowl for every man to get a thorough, clean wash without crowding. The unsanitary and inefficient features of washing in a running stream are here obviated. There is no slopping over on other men. There are no half-way attempts to get clean. There is no waste of water. Let your men put the plug in, fill the bowl and clean off the grease and grime. They can't do it in a running stream.

Send Today for Catalogue and Price List

Shelving *Lockers*
Chairs and Stools *Drinking Fountains*

METAL MEECO PRODUCTS

MFG. EQUIPMENT & ENGINEERING CO.
FRAMINGHAM, MASS.

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(*Continued from page 67*)

left to shift for itself, with no "daddy" to help or advise. I have seen the production, on an ordinary punch press, jump from 22,000 to 30,000 pieces in nine hours, where training of the help was given proper study and attention.

Fortunately, today, a large number of manufacturing plants in this country are now giving careful thought to the training of their help.

In most cases the newcomer is put into training in a section nearby the regular production work. There is a distinct advantage gained by having the trainees in the proper environment, as the atmosphere of the regular shop tends to cause the stranger to feel that he is to become part of a great manufacturing plant, just as soon as he can demonstrate his ability for the part he is being trained to take; but all trace of fear and uncertainty is banished by the fact that he is placed in a separate section and under the guidance of an instructor who is going to father him until he is able to get along without assistance. This causes the trainee to lose all nervousness and fear of the job, and his progress is thereupon much more rapid.

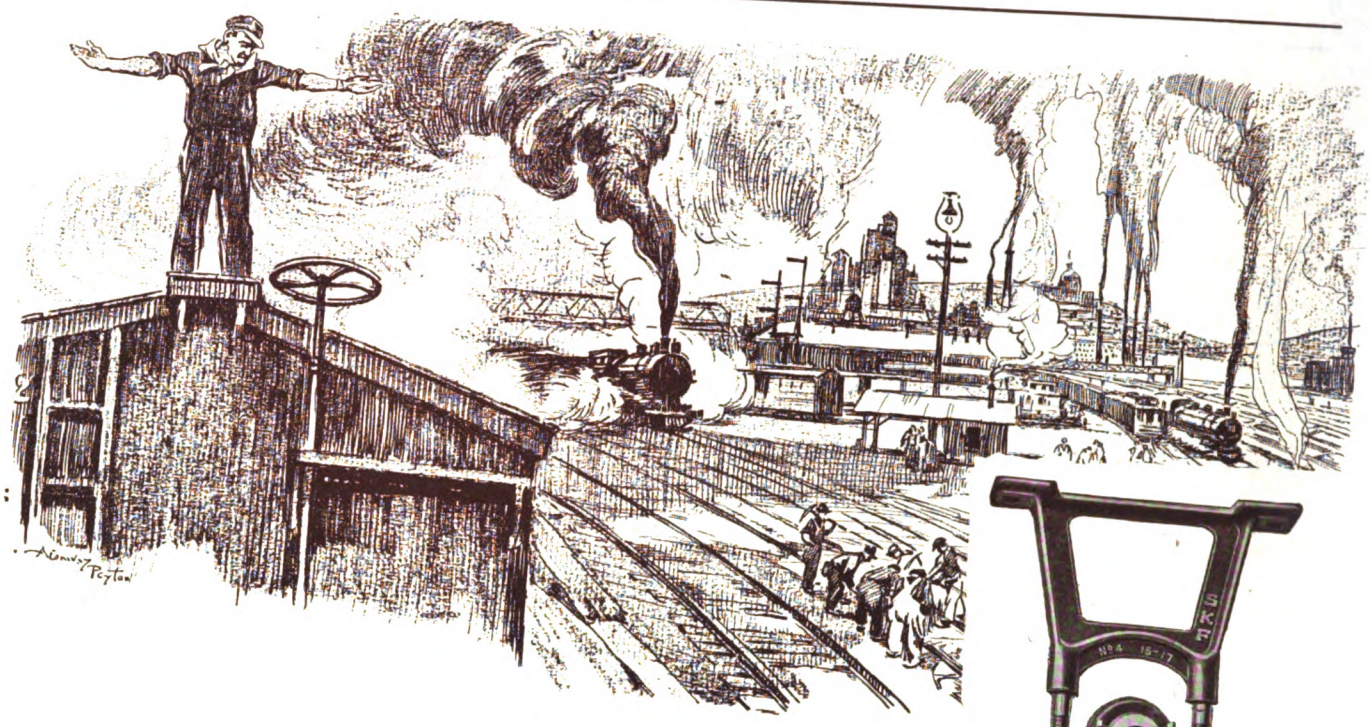
Occasionally a training section has to be "centralized" as was the case at Willys-Overland, where metal machine tools were scattered all about the plant in order to facilitate a more rapid handling of the production work. When this condition is found to exist, a few units of machine tools can be brought together in some central part of the plant and the production work brought to it for training use, then the men are trained here on the same machine and job, and when up to production and able to make piece work, promoted to the plant department.

In the radiator department, where the operations numbered into the hundreds, a segregated training section is set up adjacent to the main shops. Here the instructor receives his new help and either trains them in the section or out on the floor, when it is necessary to do so due the lesser need for men on at particular work, or because e equipment is too unwieldy move into the training section. all times the training instructor is in charge of the new n and right on the job to see t they learn well and complete training in the shortest possible time, and without waste of time, material or tools.

At the Winchester Repeating Arms Co., a unique training situation arose, when it became necessary to train and develop in an intensive manner a number of young men to become electrical wiremen.

Ordinarily it takes something like three years to train these mechanics. The Winchester problem, however, was to teach men to do the necessary wiring of unused war buildings, making them ready for shops where a line of new products were to be manufactured. Of course, these men had to be taught so that proper installation of this electrical equipment would go on without undue waste of time. However, it was not necessary to teach them all of the trade as it is universally practiced.

We set up a "training laboratory room," where the young men were received and taught Materials — Electrical Equipment — Construction—Installation — Operation — and Inspection of the electrical equipment thus installed. Academic



Brakes—Friction—Bearings

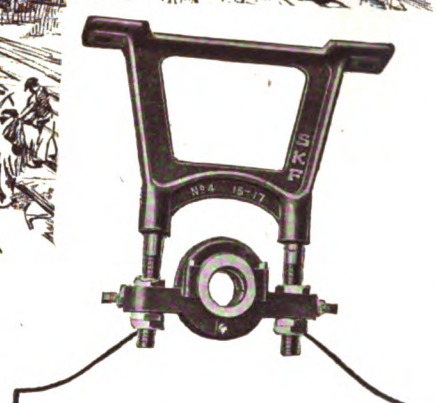
WHEN the brakeman of a fast moving train signals for the brakes to be applied, the train's motion is retarded by a sliding, dragging area of metal—friction.

When the shafting of your factory turns in babbitt bearings with their long area of metal, each bearing acts like a brake wasting in friction, heat and wear much of the power that should be available for useful work.

Just as a locomotive cannot pull against set brakes—neither can your shafting operate efficiently when its motion is retarded by friction's binding grip.

Let our engineers estimate on an installation for your plant and point out some of the savings that the 9000 users have made by removing the brakes from their line shafting. Skayef Self-Aligning Ball Bearing Hangers always pay for themselves in two years or less.

For Nearest Distributor, See MacRae's Blue Book



SKAYEF
—the 4-Saving Hanger

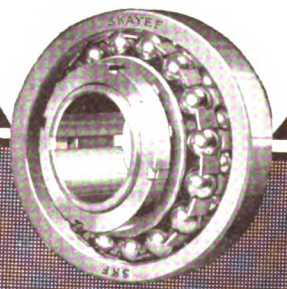
1st Saving Skayef Hangers save from 50 per cent upward of the energy which plain bearings consume in friction. This means a saving of 15 to 35 per cent of your power cost.

2nd Saving Considerable time is saved by eliminating shutdowns for replacing or adjusting bearings; forced idleness of machines and men is a cost-factor too big to be ignored.

3rd Saving Lubricant consumption reduced 60 to 80 per cent as compared with plain bearing hangers. Lubricant required only at infrequent intervals and it cannot leak out and ruin belts or product.

4th Saving There is no discernible wear of the hard steel balls and races and absolutely no shaft wear. Dust and grit cannot enter the bearings and Skayef self aligning ball-bearings have the exclusive inherent ability of compensating automatically for shaft deflections.

1112



SKAYEF
Self-Aligning Ball-Bearing
HANGERS

Made Under SKF *Supervision*

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instruction necessary was given in the company's school.

After the men had learned the laboratory work (which took about two weeks) they were assigned to a construction job, usually three men to a job. The Instructor always went out with the men to instruct them how to lay out the work, showing them the right way to do the job, and the things to watch in order to avoid errors. He would then leave the first group and go on to the next, etc. In about four weeks these units were able to go ahead unassisted, lay out their own work and complete the job, the Instructor acting only as an inspector of their work. Thirty men were trained in this manner and the company was able to start the new shops as rapidly as needed for the seasonable products they were introducing.

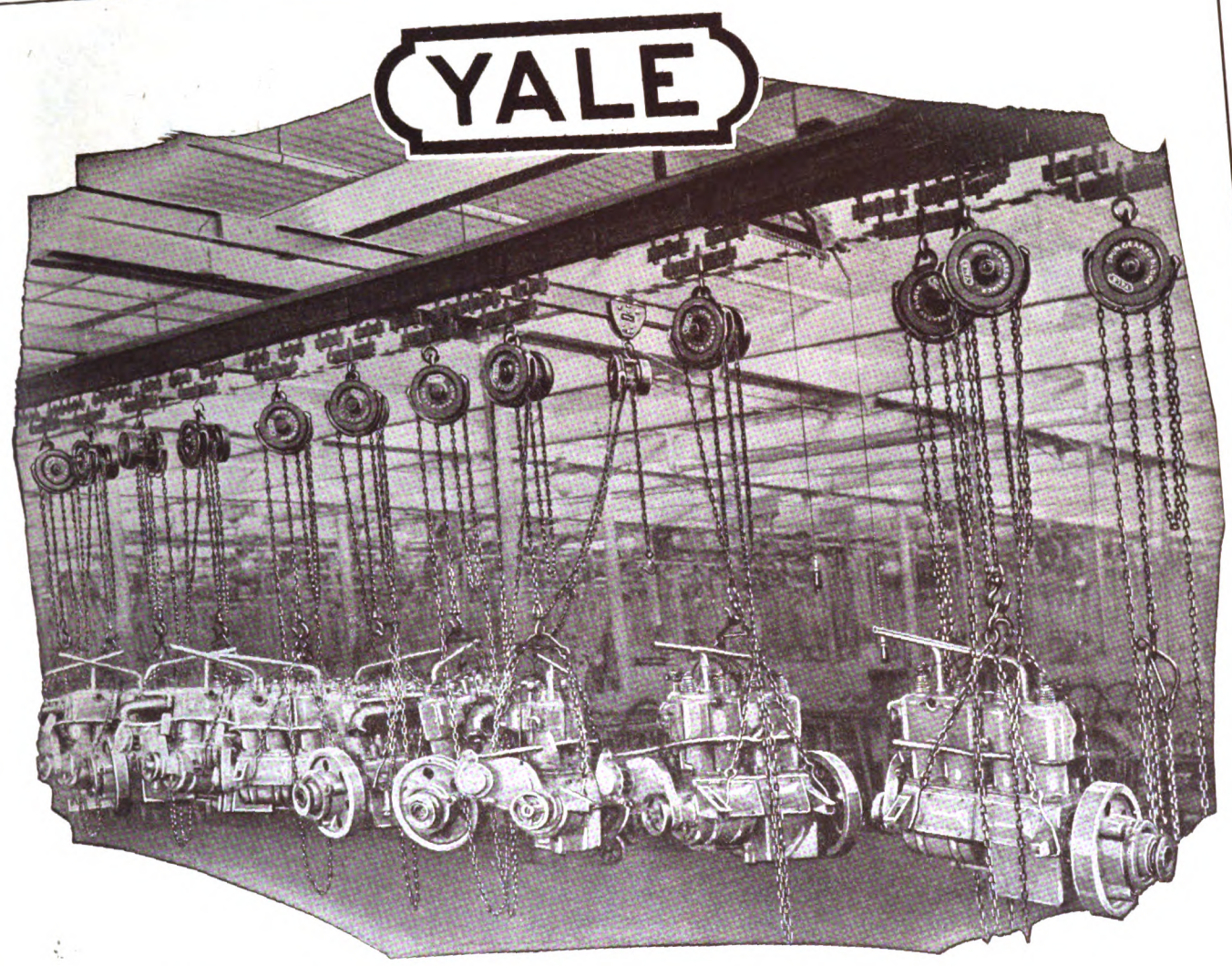
When these New Products shops were installed the Training Engineer started to set up training sections for the training of labor for these new shops. Some fifty different training sections were thus set up and the labor prepared for the different shops.

It was sometimes necessary to give the Training Engineer full charge of the new shop so that he could act as a mentor to the nominal foremen, sub-foremen, tool-setters, planning, scheduling, and production supervisors. In other words the whole shop was, for the time, in training, and when the shop was running well and everything orderly and the production up to schedule, the Training Engineer retired from that particular shop. But his training organization continued to train the labor necessary to keep down the normal turn-over.

Plant managers who have investigated "Training On the Job" have found this method profitable; have found that increased production problems have disappeared when they have installed a well-conducted training plan in their plants, where not only the "green help" but a good number of the men already in the shops can be taken into training and developed into profitable factors, both for themselves and the company.

James J. Davis, Secretary of Labor, says in "TRAINED MEN," "First comes the human element as our best promise of continued prosperity and human expansion, if that human element is trained and fitted to meet the peculiar problems which face the American manufacturers today. In the past we turned our attention to our machines, today we must think in larger terms of the human element which towers above those machines. We must have trained workers, trained executives. Of course no man can learn by himself. None by taking thought can acquire knowledge. *He must be taught and a scientific job must be made of the teaching.* Especially is this true with the workman whose earlier training may have been limited. The human element comes first and I want the employers in industry to understand the aspirations, the convictions, the yearnings of the millions of American wage earners. And I want the wage earners to understand the problems, the anxieties, the obligations of Management and Capital."

The above is good counsel and advice, but the rank and file as I find them in Industry today do not learn these truths, and more often there is no method set up to teach them.



Here's the answer to the labor shortage

YALE Spur-Geared Chain Blocks and I-Beam Trolleys are always ready for the specialized job of lifting and moving heavy machinery.

Keep your men at work, productively. You are paying twice as much for labor as you did twenty years ago, and even at that it is hard to get.

The illustration above shows how one well-known manufacturer of motor cars has solved the problem of this labor shortage—and you no doubt have a problem that can be solved in very much the same way.

Whenever a motor goes off the assembly floor in this plant it is carried on a Yale Spur-Geared Chain Block and I-Beam Trolley. This represents a big saving.

Yale Spur-Geared Blocks can always be trusted to carry costly machinery with safety and dispatch. Yale Blocks and Trolleys are individually tested to 50 per cent overload and every vital part, from hook to hook a line of steel, is made strong enough to stand the strain of emergency loads greatly in excess of the rated capacity.

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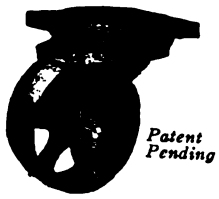
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No. 15

The Zering No. 15 is used in practically every industry. It has shown tremendous ability to stand up under hard usage.



Patent Pending

Champion Adjustable Double Race Casters

These casters are used upon all Zering ball bearing platforms and trucks. They outlast the truck; give perfect service and can be adjusted by the turn of a nut without removing them from the truck.

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This truck is also fitted with Champion Plate Casters. By reason of this, bolster breakage is avoided, a common fault with trucks having side bolt caster. Rails tenoned and grooved and bolted to side rails. Heavier loads can be handled with less effort.

Made in all sizes.

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Manufacturers of trucks, trailers, casters and skids



At Your Service

INVENTORS and builders of small motor driven tools and machines—confronted with perplexing power problems—are invited to take advantage of the services of our Engineering Department.

This department has for many years been in close contact with the uses and application of small motors. Their experience is offered to you as a help in the working out of your own problems.

We will gladly co-operate with you in the building of a *better* product. Do not hesitate to call on us for advice. Our combined efforts will, perhaps, result in another appliance being made more saleable and more dependable because it is equipped with a motor that is exactly adapted to its particular job.

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Type-A—Stripped
⅛ h. p. Cast iron frame, enamel finish. Babbitt bearings, wick oil feed. Operates on A.C. & D.C.



Type-D
⅛ h. p. Cast iron frame. Enamel finish. Plain bearings. Grease cups. Operates on A.C. & D.C



No. 3GM—Stripped
¼ h.p. Aluminum frame, enamel finish. Normal bearings. Ventilated. Operates on A.C. & D.C.



Type-SAX
Motor 1/25 h. p. Special base.

DUMORE

FRACTIONAL H.P. MOTORS

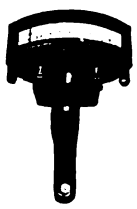
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Are the kind that the discriminating manufacturer buys. The reason being all round satisfaction and dependable operation.

Mention your products. Literature and data that is of direct assistance to your production will be sent.





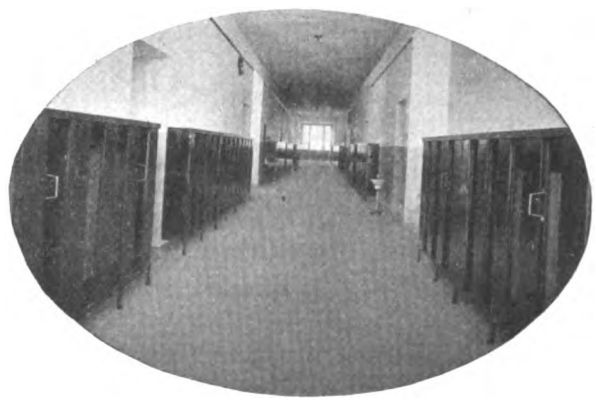
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There are many reasons why Marbleloid *Permanent* Flooring is used extensively in Industrial buildings for Offices, Laboratories, Hospitals, Cafeterias, Welfare Rooms, Workrooms, Toilets, etc.

It is fireproof, resilient, non-abrasive, non-slipping. Does not require expensive upkeep and can be laid upon old or new wood or concrete floors. It is a standardized lightweight composition flooring, manufactured, installed and guaranteed without restriction by us. Laid plastic, it sets in a few hours into a seamless, smooth surfaced floor, good for a life-time of service.

The Coupon below will bring you the detailed advantages and cost of installing Marbleloid Floors in your new building or for resurfacing your old floor.

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The Universal FLOORING for Modern Buildings

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THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building.....; below are the approximate areas involved.
Floor.....Sq. Ft. Sanitary Base.....
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Our floors are
☐ New Concrete ☐ Cement Finish ☐ Wood
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☐ Please send 32-page Illustrated Booklet.

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Modern Bearings and Their Lubrication Problems

(*Continued from page 25*)

the bearings of any machine or piece of equipment are those parts which carry or guide the necessary revolving, sliding, rolling or reciprocating mechanisms. Thus, it is evident that bearings are a factor wherever mechanical motion exists.

According to the type and function of the machine or piece of equipment the movable parts are usually termed journals, shafts, pins, rods, shoes or spindles.

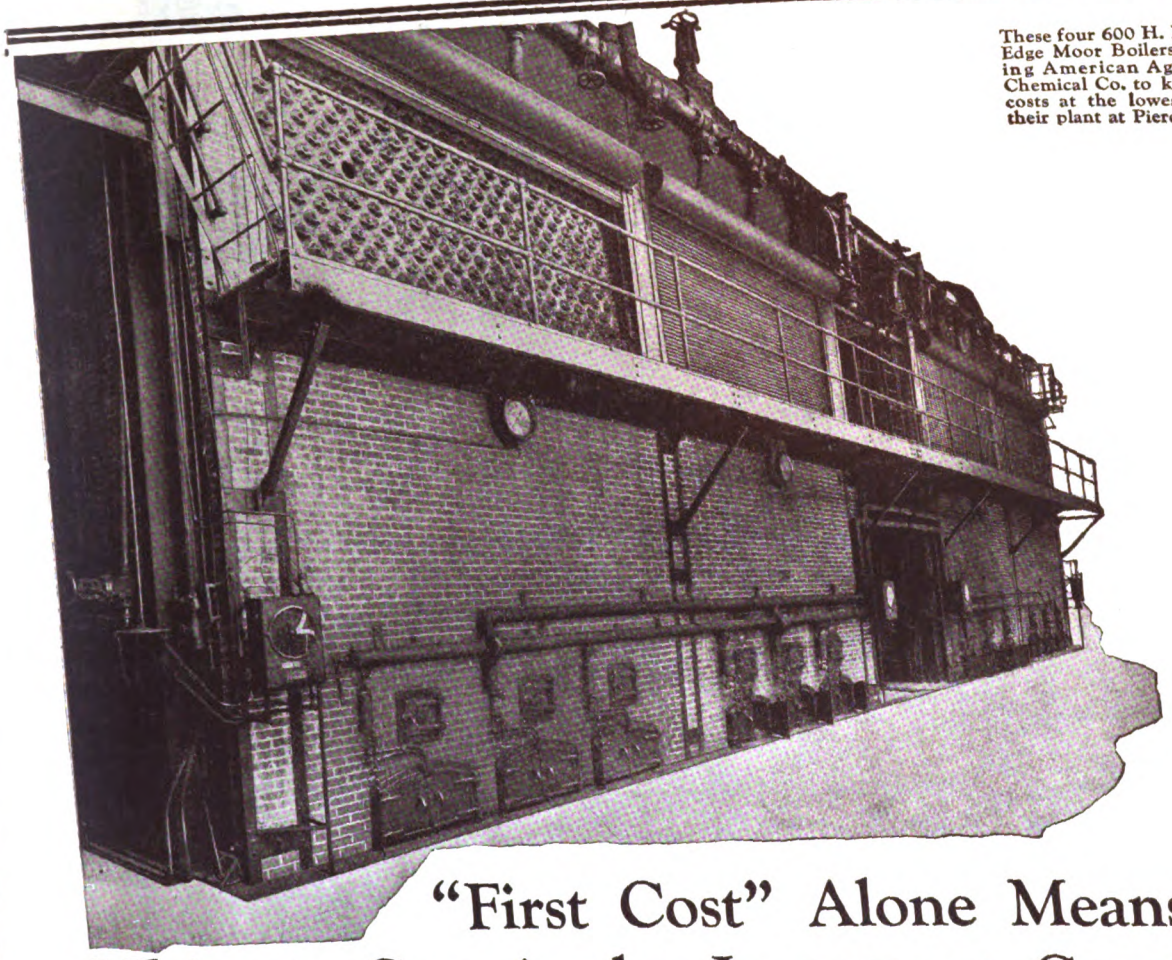
Bearing surfaces are classified according to the manner in which the load is carried. Thus, where the line of application of the load is at right angles to the bearing, the latter is known as a shaft, journal or guide bearing. In contrast, where the load is exerted parallel to the axis of the earing, the latter is commonly termed a step or thrust bearing.

Shaft and journal bearings are best considered together, on account of their similarity. In general they consist of cast iron or brass bearing pieces which are mounted in the bearing blocks, and surfaced with Babbitt metal or some other so-called anti-friction compound which has a relatively lower melting point than the shaft or journal. Thus, this surface of bearing metal serves as a protection for the bearing pieces, especially where they are of brass, both by virtue of its lower melting point and the comparative ease with which it can be renewed in event of its becoming overheated to a sufficient extent to cause "burning out," or being scored or worn by the presence of foreign matter in the lubricant.

Guide bearings are somewhat similar in principle to shaft and journal bearings, and require surfacing or babbitting in the same manner to protect both the bearing pieces and slides. Bearings of this type, however, are generally flat or slightly concave, and are fitted on one or both sides of the moving part in order to preserve its alignment during operation. Reciprocating motion is usually customary in guide bearings involving sliding friction. The crosshead shoe in a reciprocating engine and the lathe bedplate are familiar examples.

Step and thrust bearings are used where it is necessary to take up pressure along the axis of a rotating shaft or journal. They may be built either horizontally or vertically, depending upon the type of machine they are designed to serve. Horizontal thrust bearings in general will only be required to take up end thrust, or, in other words, the pressure of operation. Vertical step and thrust bearings on the other hand, must be capable of both serving this purpose and, as well, of carrying the weight of the revolving parts, as is the case in the vertical hydraulic turbine.

If we are to be able to judge whether a lubricant will adequately serve its intended purpose and give a lubricating film of suitable thickness in any bearing, the various types of bearings in common industrial use, and their principles of construction, must be understood. It has already been noted that bearings can be broadly classified into two groups according to



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Ultimate Cost is the Important Consideration

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The efficiency of your boilers over their period of service determines their cost to you—not the price quoted by the maker.

The difference in first cost is frequently offset in the first few years of service. It is easy to determine, for example, the saving in fuel you could effect by increasing your boiler efficiency 2% or 5% or 10%.

Edge Moor Boilers are built to deliver the highest practical efficiency under any given set of operating conditions.

In choosing the boilers for your new power plant, consider the ultimate cost. The Edge Moor catalogue will help you to determine the figures; shall we send you a copy?

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Established 1868
EDGE MOOR, DELAWARE
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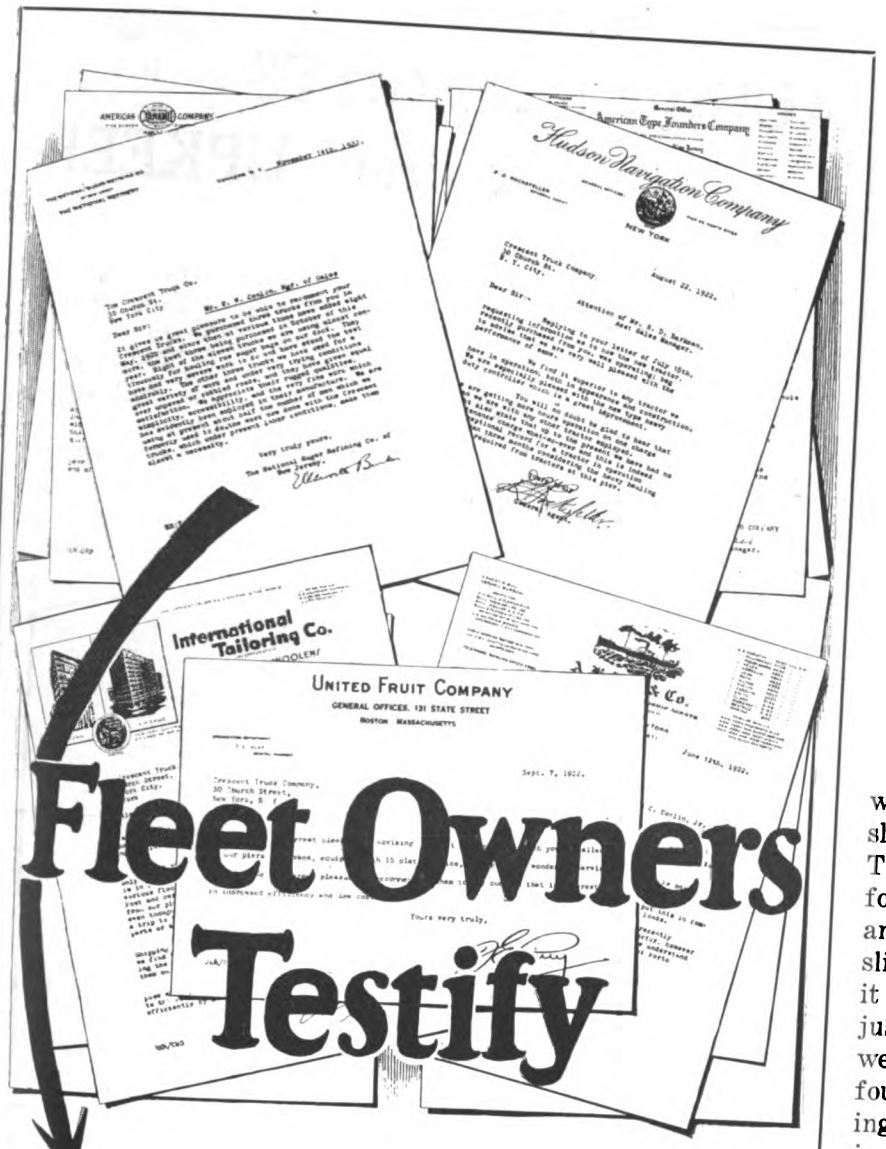
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"Have given us wonderful Service."
"Superior to any tractor we have."
"Savings has been quite considerable."
"This truck saves us $150.00 monthly."

These are only a few of the many letters we have received from users of Crescent Electric Trucks and Tractors. They come from representative firms in dozens of industries; firms whose operating efficiency is well known; firms who demand equipment that stands up under the hardest service.

The supreme quality of Crescent trucks and tractors is their ability to stand the constant hard wear to which they are subjected. Nothing goes in a Crescent that is liable to "go out" at an inopportune time; from the steel, hot riveted frame, to the specially designed General Electric motor, Crescent parts are as wear-proof as human brains and material brain can make them.



Crescent Truck Co.

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Foreign Representatives:
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Send for our booklet, it contains 48 pages of cost reducing facts.

TRUCKS CRESCENT TRACTORS

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ELECTRIC TRUCKS & TRACTORS

the manner in which their load may be applied. These classifications can be further subdivided in accordance with design and construction, *i. e.:*

(1)—*Shaft Journal or Guide Bearings.*
- a. Solid bearings.
- b. Solid bearings with bushings.
- c. Two-piece bearings.
- d. Four-piece bearings.
- e. Guide bearings.
- f. Ball bearings.
- g. Roller bearings.

(2)—*Step or Thrust Bearings.*
- a. Plain sliding bearings.
- b. Ball thrust bearings.
- c. Roller thrust bearings.
- d. Horse-shoe thrust bearings.

Solid bearings constructed with or without bushings or sleeves are built in one piece. The shaft or journal can, therefore, be inserted or removed in an endways direction only, by sliding it in or out; as a result it is not possible to make any adjustment to compensate for wear, as it is in a two-piece or four-piece bearing. Solid bearings, however, with all this objection are advantageous in that they are relatively inexpensive, and can be applied equally well to horizontal or vertical service. They are in general used where low pressures, slow speeds and light wear occur. Horizontal bearings of this type are used where loose pulleys are involved, or for miscellaneous smaller shafting on cranes and hoists, etc., and as wrist pin bearings in steam and gas engine installations. In vertical installations solid bearings include the supporting or guide bearings for textile spindles, and the footstep shaft bearings in certain other machinery.

When wear is liable to be abnormal, solid bearings fitted with bushings are often substituted. Thus, as wear occurs, it is a comparatively easy matter to slip the shaft out from the bearing, whenever necessary, renew the sleeve or bushing, and be ready for efficient operation once again with little waste of time.

Two-piece bearings, or bearings which consist of two parts such as a bearing block and cap, are extensively used in the modern industrial plant for general shaft and journal purposes where solid bearings would not be applicable. Frequent examples of such bearings may be noted on line shaft hangers, and

(*Continued on page 75*)



JOINTS! They cause all the trouble in fire brick linings. They're the weak links that give 'way under the heat of the furnace and that make the need for entire relining certain.

Eliminate them. Install jointless Plibrico Furnace Lining, the way the man pictured above is doing. Pounded in while plastic with a mallet, Plibrico forms a one-piece, rock-like lining when heat is applied. It lasts two to four times as long as fire brick. It cuts heat loss through the setting. It can be installed by unskilled labor. It resists temperatures to 3100 deg. F.

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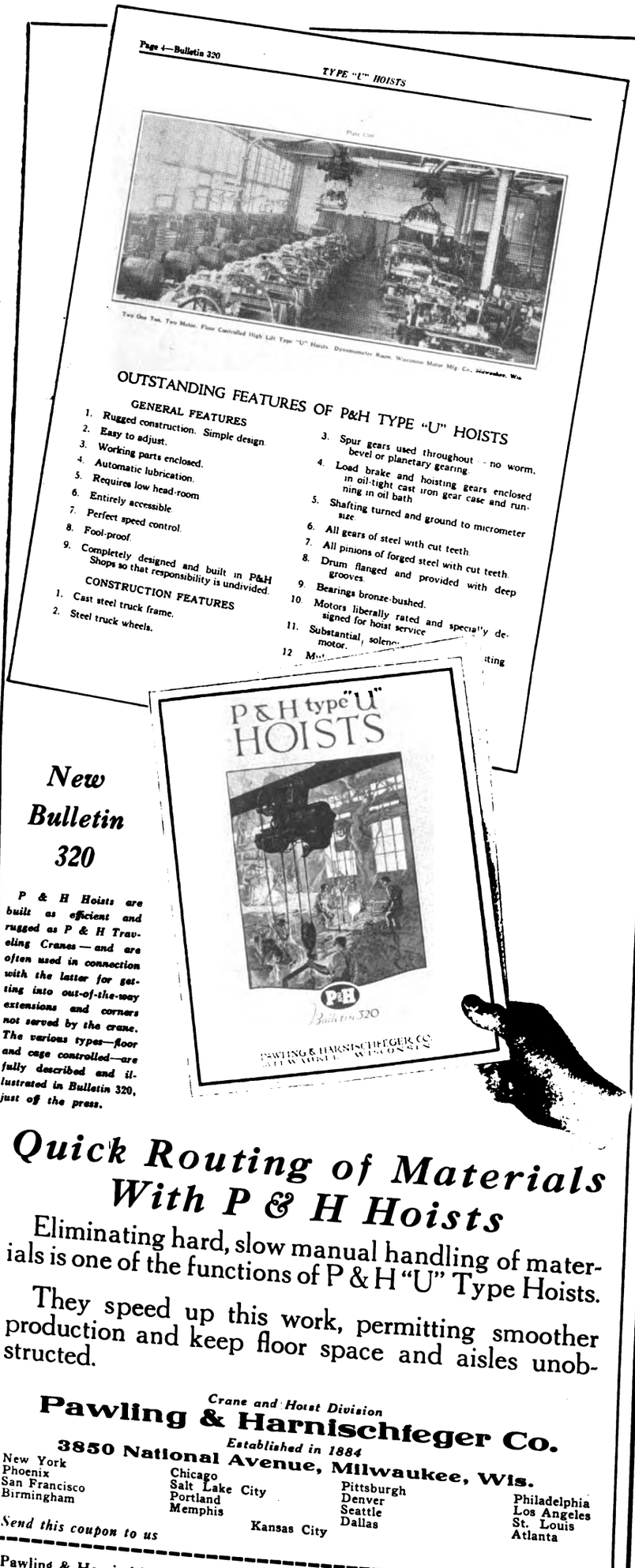
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New Bulletin 320

P & H Hoists are built as efficient and rugged as P & H Traveling Cranes — and are often used in connection with the latter for getting into out-of-the-way extensions and corners not served by the crane. The various types—floor and cage controlled—are fully described and illustrated in Bulletin 320, just off the press.

Quick Routing of Materials With P & H Hoists

Eliminating hard, slow manual handling of materials is one of the functions of P & H "U" Type Hoists.

They speed up this work, permitting smoother production and keep floor space and aisles unobstructed.

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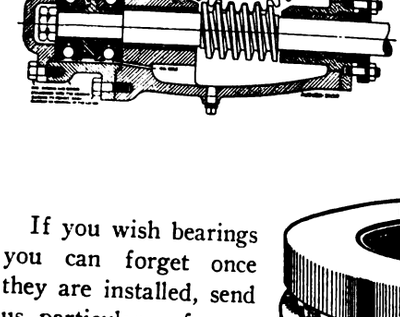
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If you wish bearings you can forget once they are installed, send us particulars of your problem and ask for circulars.

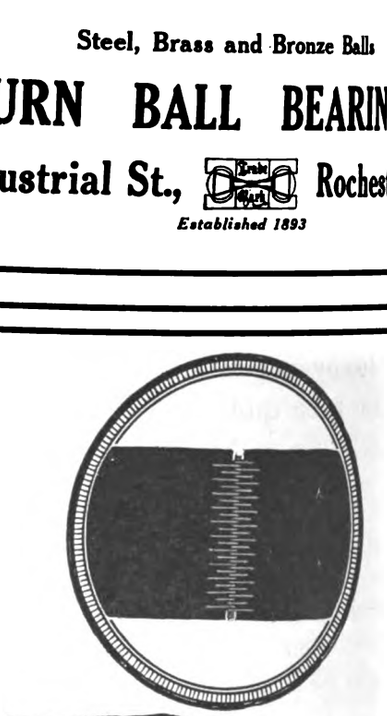


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(*Continued from page 73*)

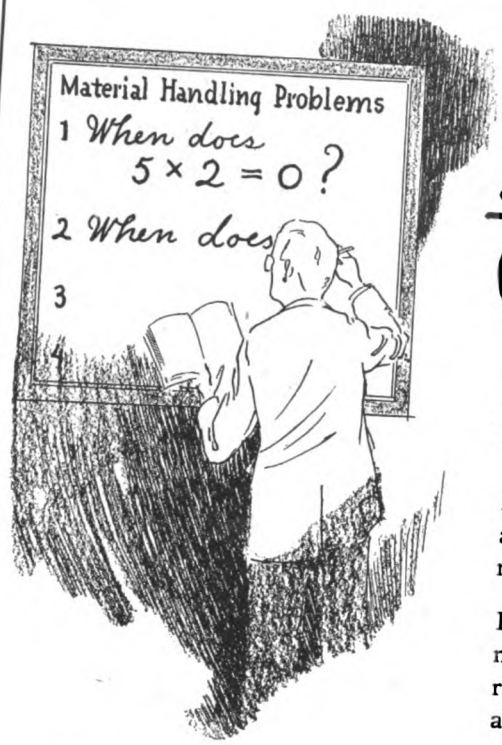
for engine crank pins and connecting rods, etc. In general, such bearings are suitable and most comomonly used where the shaft pressure is directed either against the top or bottom brass. In line shafting this will be the usual condition. Certain conditions may, however, cause this pressure to be directed towards the junction of the top and bottom bearing pieces, in which event it is usually advisable to substitute a so-called four-piece bearing. The direction of pressure against any bearing junction will often have a tendency to pound the bearing out-of-round, or press the bearing metal into the chamfered edges.

Four-piece bearings, therefore, are effective in such cases. Four-piece bearings consist of four brasses, each one being independently lined with suitable bearing metal, and securely held in the bearing block or cap. Each piece of a four-piece bearing is usually furnished with adjusting screws and wedges for its adjustment in case of wear. Thus, any individual bearing piece can be located properly with respect to the shaft, and a suitable operating clearance can be constantly maintained. Four-piece bearings are generally used as main bearings of larger horizontal steam and internal combustion engines.

Guide bearings are chiefly used on reciprocating steam engines, steam pumps, air compressors, ice machines and vertical dynamo and blower engines. In general, bearings of this nature are subject to very little wear, and they usually are allowed sufficient clearance to permit of free and ready circulation of the lubricant. In horizontal engines and other similar installations where guide bearings are involved, the lower bearing carries the weight of the moving part such as the crosshead. In such cases the top bearings serve practically entirely as guides, and are subject to relatively no load. Vertical side bearings are usually subjected to equalized pressures, which are in general comparatively low unless the clearances are either abnormally slight, or so high as to allow the crosshead to pound or slap against the bearing surfaces.

Ball and roller bearings, though differing in design and construction, both embody the principles of rolling contact and are therefore, subject to rolling friction. As their names imply, such bearings consist of either a set of perfectly spherical balls, or a number of solid cylindrical rollers of highly polished steel, which are carried in circular grooved rings or containers, known as races or cages. They surround the shaft, their innermost points rolling in close contact with the inner ring or raceway which is fitted to the shaft; the outermost points roll in contact with the inner circular surface of the bearing retainer or outer raceway, according to their design. Ball and roller bearings have a marked advantage over plain bearings, by virtue of their smaller area of contact. Theoretically ball bearings are subject to point contact, while roller bearings involve line contact. With both types there must be practically no freedom of motion other than rolling.

Ball bearings are claimed to have certain advantages over roller bearings in that (1) They never cause end thrust; (2) Their load carrying capacity is equal to that of roller bearings,



5 Mercury Tractors 2 Years' Service 0 Replacement Parts

ELECTRIC tractors are noted for their low maintenance cost. This naturally follows from the small number of parts and the simplicity of construction of such a machine.

It is all the more striking, therefore, when a new model tractor shows a marked improvement in this respect over the best of the existing models. This is exactly what the new Mercury Type-H has done.

Five of these machines that have been in service over two years have never required a single replacement part on the drive. This is a record for low maintenance which we are confident has never been approached by any industrial tractor on the market.

How The New Type-H Makes This Possible

Introduces a balanced internal gear drive of entirely new design, eliminating the friction losses inherent in the worm drive. This results both in low operating cost and an absolute minimum of upkeep for the "power plant."

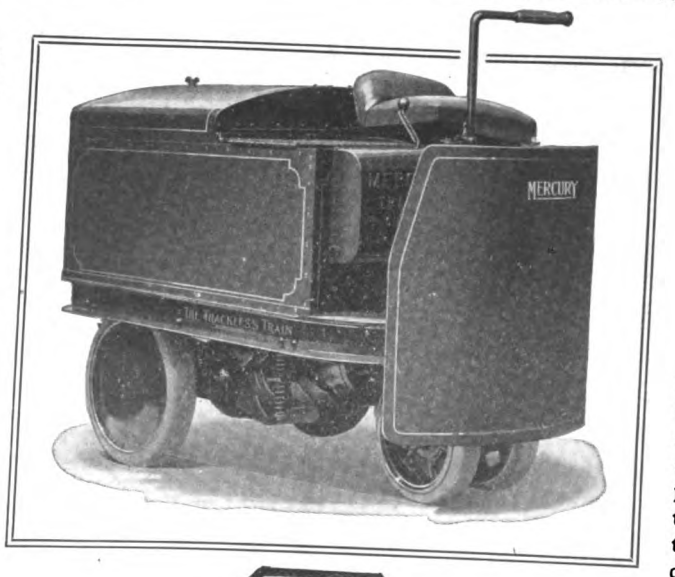
Retains all valuable features developed in previous Mercury models including:

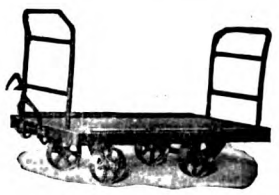
1. Special safety features effectively insuring against danger, even in the hands of inexperienced workmen.
2. Drum type controller of special design having long life, dependability, simplicity, ease of inspection and adjustment.
3. The exclusive Twin-3 front wheel assembly combining full spring suspension with the short turning radius of older 3-wheel models.
4. Frame of channels and angles hot riveted to combine maximum simplicity, rigidity and strength.

Fleet Owners

The Mercury organization pioneered in the field of electric industrial tractors, and for more than 8 years has made such tractors and trailers exclusively. It is therefore not surprising that a preponderance of all the large installations are 100% Mercury. A few of the large fleet users (over 10 machines) are the following:

American Railway Express Co.
American Radiator Co.
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United States Government
Studebaker Corporation
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Willys-Overland Co.
American Car & Foundry Co.
Kewanee Boiler Co.
Eastman, Gardiner Lumber Co.
Standard Oil Co.
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Chicago Burlington & Quincy R.R.
New York Central System





Trailers

And to complete the "Trackless Train" there are Mercury trailers of just as distinctive merit as the tractor. There are various designs for special purposes, but the A-310, illustrated above, is an all-purpose trailer which meets most all ordinary industrial conditions.

Mercury Manufacturing Company

4112 South Halsted Street — *Chicago, U. S. A.*

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and at high speeds claimed to be even greater; (3) They normally show less tendency to become overheated, due to their lower operating friction; and (4) They occupy less space per unit of load.

On the other hand, ball bearings possess certain disadvantages since (1) The greater need for accuracy in their construction often makes them more costly to install; and (2) It is impossible to replace them on long lines of shafting, etc., in case of failure, without considerable dismantling of equipment. Roller bearings, on the other hand, are usually built with both the cage and bearing liner in two halves, and can be readily replaced by rolling the desired half out from contact with the shaft.

Thrust bearings have already been briefly mentioned, in general. They are distinguished by the manner of their construction and the means employed to take up axial thrusts developed by the revolving parts, or the weight of these latter. A plain or sliding thrust bearing is, therefore, one where sliding motion is involved, collars being located on the revolving parts which transmit the pressure to a corresponding set of stationary collars in the bearing housing.

On plain thrust bearings the manner in which the lubricating oil is introduced to the bearing surfaces, and the oil film maintained is important. Lubrication will, of course, depend to a considerable extent upon the intricacies of design and construction.

Variations in the design of discs or bearing collars are sometimes tried out and attempt is often made to simplify the step bearing in particular by use of one or more collars, according to the pressure involved. Still, the single collar thrust bearing, regardless of speed or pressure, is considered as the most reliable. In such a bearing the collar (often known as the foot-step) rides on a set of fixed segments which comprise the bearing surface. Each of these segmental pads is built capable of pivoting or rocking independently and thus assuming whatever inclination to the moving surface the pressure, speed or body of the oil may require. Although there is practically no metallic contact, these bearing pads are usually faced with bearing metal in order to insure protection of the foot-step in event of improper lubrication or the entry of abrasive material.

Thrust bearings of this type may contain a varied number of pads. As a rule, however, six is the maximum. Such bearings can be applied to horizontal as well as vertical installations. The essential characteristics in a plain thrust bearing lubricant is the viscosity. Compound is unnecessary, and straight mineral oils are preferable. The requisite viscosity will, of course, depend upon the size of the bearing, the oil pressure, and the speed and operating pressure of the machine.

Ball and roller bearings are also variously used in certain types of thrusts. Where roller bearings are employed they are usually fitted with tapered rollers. For such service they must be extremely accurately machined and fitted, otherwise abnormal end thrust will be developed. Where end thrust is minimum, friction will be independent of lubrication. The occurrence of any appreciable end thrust, however, will cause friction to be developed between the

(Continued on page 78)

Who Makes the Rules and Why?

It's against the rules to allow most recording instruments to stray from a limited "working range." You must keep off the grass.

To play safe you must use an instrument with a much wider chart scale than is necessary. One that's usually difficult to read accurately.

Manufacturers are forced to make such rules because of the inherent weakness of the actuating movements of their instruments.

When the Foxboro Improved Helical Tube Movement was perfected 2½ years ago Foxboro Recorders were immediately freed from such obsolete rules and restrictions.

Foxboro Recorders are not hobbled within a limited "working range."

Select a Foxboro Pressure Gauge or Thermometer with the scale range that's easiest to read.

Use it constantly at maximum range if you wish.

The Improved Helical Tube Movement will not fatigue, split, leak or crack even when subjected to excess pressures that carry the pen way beyond the outer edge of the chart.

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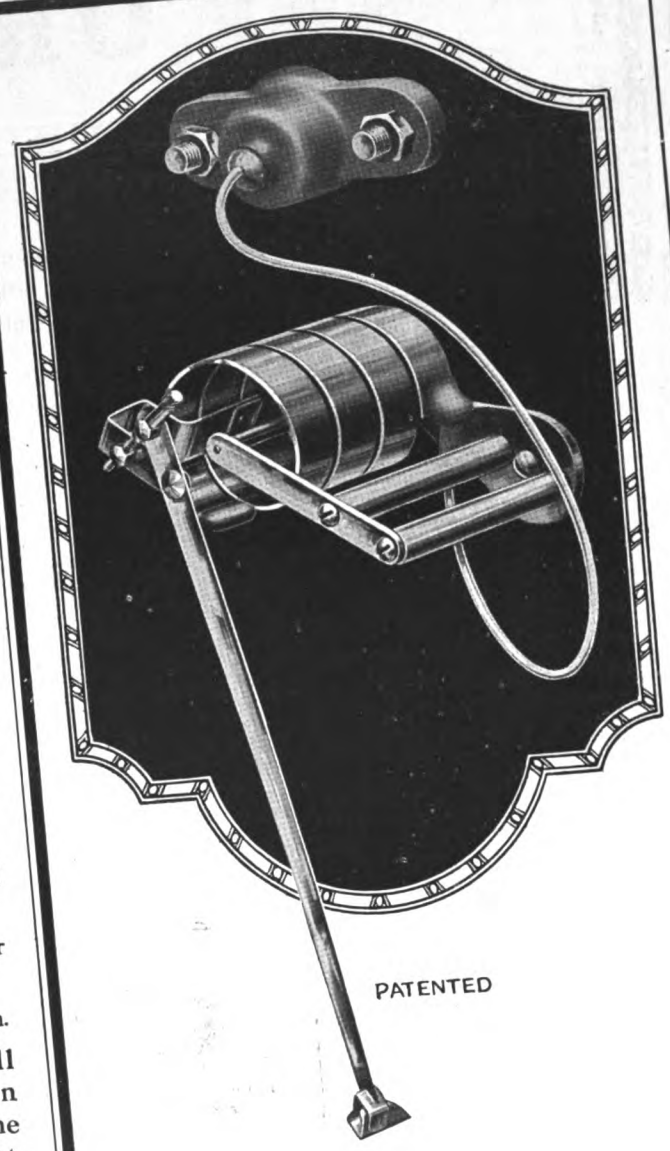
Accuracy within less than 1% of total scale reading is guaranteed.

The Foxboro Improved Helical Tube Movement is a great achievement in recording instrument construction.

Rules required to keep less sturdy instruments in calibration do not apply to the Foxboro Movement.

For accuracy, dependability and convenience install Foxboro Recorders, the only instruments with the Improved Helical Tube.

Write for Bulletin 154-A.



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Are Your Material Handling *"Economies"* Wolves in Sheep's Clothing?

"What is the price of your platforms?"

Many a time the prospect's interest seems to center in the answer to this question. And, too often, the lowest price gets the order!

The result is a saving, true, but it's a "wolf in sheep's clothing!"

He can't understand why a platform must be as strong and wear-resisting as a lift truck.

So he compromises. He buys platforms that he is told are "just as good" as Stuebing "Steel-Bound."

He overlooks the significant fact that *if they were really just as good they'd cost more than Stuebings!*

You can take your choice! Either you can save money *on* platforms, or you can save money *with* them. *But* you can't do both!

And the only real, tangible *savings* are those day by day economies which are earned by staunch, dependable equipment that does your bidding without falter.

There is no substitute for the lifelong, trouble-free service of a "Steel-Bound" Platform. When you use these platforms and Stuebing Lift Trucks each is the equal of the other—*and both are unequaled by any other made!*

Ask any one of the big industries of the country why they pay the slight additional cost of "Steel-Bound." They'll tell you it's the most economical platform they have ever been able to find. Isn't that what *you* want?

Use the coupon below and let us give you facts that most certainly will be of interest—*and profit.*

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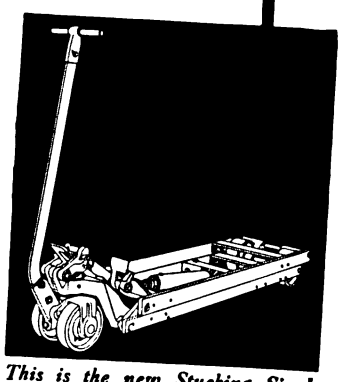


1 *Steel-Bound the full length.* Powerful clamping prevents sagging. Strongest where ordinary platforms are weakest.

2 *Forged steel bolts* with large heads anchored in the steel rails clamp oak top, side rails and steel legs together in a vise-like grip.

3 *Forged steel legs* support heaviest loads indefinitely. Won't wear down or wabble. Broad smooth surface prevents damage to floors.

4 *Oak top,* of selected wood. A wear-resisting surface that protects fragile materials from chipping and holds machine products from slipping.



This is the new Stuebing Single Side Lift—a revelation in lifting ease, in convenience and in safety of operation and economy of service... There are Stuebing Lift Trucks of every kind and size to meet every interior hauling need

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(*Continued from page 76*)

roller cage and the runway, and straightaway lubrication will become of decided importance. The better the oil films naturally the more effectively will such friction be overcome, especially at high operating speeds.

Grease and oil are both used for the lubrication of ball and roller thrust bearings. As a rule it is well to keep to as low a viscosity in the lubricant as possible, due to possibilities of internal friction being developed. In ball bearings friction will be oftentimes greater when even a light lubricant is used, than when the balls are run dry. The function of the lubricant is largely to serve as a preservative for the highly polished metallic surfaces involved. The construction of the bearing housing and the operating temperature will influence the choice of the lubricant, a light grease or medium viscosity oil being selected according to the tendency there may be for leakage from the housing, etc. Grease, in any case, will prove the more effective seal against dirt or dust.

Another type of thrust bearing is the "horseshoe," which is chiefly employed in marine service. On shipboard the thrust bearing is the connecting link between the engine and propeller shafts, and its function is to take up the axial thrust exerted by the propeller shaft, transferring this thrust to the hull of the ship and keeping it from reacting upon the engine. The typical horseshoe thrust bearing consists of a length of shaft equipped with a number of collars which press against an equal number of horseshoe shaped yokes set in the bearing block. These are capable of adjustment along the line of the shaft in order to facilitate equalization of pressure. The faces of these horseshoes are babbitted in order to permit of renewal in event of abnormal wear occurring through sliding contact with the shaft collars.

Of course, lubrication of the thrust bearing in a marine installation is a decidedly important factor. Variations in temperature, differences between any of the shaft collars and horseshoes may readily bring about an unequal distribution of load with consequent overheating. To eliminate this occurrence as much as possible the most careful attention must be given to lubrication. Wick feed in conjunction with bath lubrication is generally employed on a horseshoe type thrust bearing, the wick feed receptacles being built into the tops of the horseshoe yokes, and the base of the bearing serving as an oil reservoir. This latter is kept sufficiently filled with lubricant and the shaft collars run with their lower parts submerged.

The various fluid, semi-solid and solid lubricants that are used for the lubrication of bearings in general, are of interest. Where and when to use any one of these naturally will depend upon the type of bearing, the lubrication system installed and any intricacies of operation involved. In general we must consider the effect the lubricant will have in bringing about a decrease in

(1)—Power transmission losses.

(2)—Bearing friction losses.

(3)—Time losses in event of repair.

(4)—Necessity for replacement of parts.

All these if reduced to a mini-

(*Continued on page 80*)

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The Heavy-Duty Engine for Every Power Requirement

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Many of the larger utilities have one or more Troy Engines in their plant, conserving fuel, and giving the assurance of the maximum of power at minimum cost. Industrial plants of higher efficiencies are also turning to Troy for use where greater power in smaller space is required. A group of prominent stoker manufacturers have standardized on Troy Engines for stoker operations.

The new Troy is the last word in steam engine design. All the features which have made Troy superior to other types are retained in this new Troy. The self oiling feature—the balanced valve which clears the cylinder of condensation, automatically and the guarantee of safety—all these have been retained in the new Troy. But in addition it is designed for greater durability, more compactness and greater strength. It is fully enclosed and the number of parts subject to wear have been greatly reduced.

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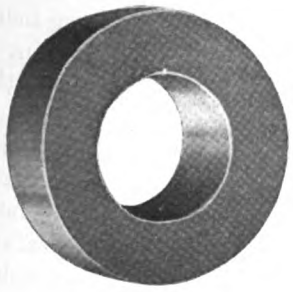
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"They hold their shape till worn to a stub"



The Why of Ring Crushing

KINETIC energy is the only force that can be utilized under the old methods of crushing—and we know that as kinetic energy increases, power cost likewise increases. But now the ring method of crushing takes advantage of a one and three-fourths ton centrifugal force behind each of the great manganese rolling rings and applies it ten times each second.

This cost-free centrifugal force added to the kinetic force accounts for the performance at low speed of ring crushing and pulverizing. That is why it presents an operating economy heretofore unknown.

We have detailed reports telling just how this power economy is asserted in handling various materials. Tell us the material you want to crush.

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TRY THIS TEST AT OUR EXPENSE:

Ordinary concrete floors are so soft that a knife will easily scratch the surface. However, if the very same floor is Agatized, it becomes so hard that the knife slips off without scratching.

To demonstrate this to you, we want to send you a small cement slab, finished exactly as your cement floor is finished. One half of the slab has been chemically **hardened** with Agatex—the other half left untreated. The knife scratches quite easily into the ordinary cement, but on the Agatized portion it slips off like hardened steel.

Floors Last Twice as Long

Can you picture the difference such a treatment would make on your own concrete floors? All "sanding" and dusting is stopped immediately. Your floors take harder wear and last probably twice as long.

Agatex saves building owners thousands of dollars each year on Concrete Floor Maintenance. Its cost is very small—it is easy to apply (mixed with water and swept into the floor with a broom): Agatex hardens concrete by chemical reaction.

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Your inquiry puts you to no cost or obligation.

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(*Continued from page 78*)

mum will automatically promote increased production and greater efficiency in operation.

Fluid lubricants include all products, regardless of their nature, which are capable of flowing at room temperature and are used for the purpose of lubrication or the reduction of friction. Most commonly, fluid lubricants are understood to cover petroleum oils, animal, fish and vegetable products. Thus, steam engine oils, castor, cottonseed, neatsfoot and whale oils, etc., all fall under this category. Water is also an effective lubricant in certain cases. Petroleum oils consist chiefly of hydro-carbons, that is, a more or less complex association of hydrogen and carbon. They are capable of fractional distillation whereby the crude oil can be broken down (by action of heat) into several components of varying boiling points. The viscosity and other characteristics of each will be different. The viscosity is one of the chief determining characteristics of any lubricating oil. Vegetable and animal oils cannot be subjected to distillation without a certain amount of decomposition. They are therefore called "fixed oils."

The extent to which any of these oils will be applied to bearing lubrication will depend largely upon the service to which they are subjected. Certain properties such as viscosity, pour test, oiliness, carbon residue, etc., must practically always be taken into consideration.

Then we have what are known as semi-solid lubricants or products which will not flow normally at average temperatures. Among these are tallow, lard, residual mineral products, etc. In general semi-solid lubricants also include greases or compounds of mineral oils and saponified fatty products, vaseline and the various grades of petrolatum. As a general rule pure mineral products such as petrolatum residual gear lubricants, or the compounds known as cup, sponge and railroad greases which are mixtures (or intimate emulsions) of mineral lubricating oils and soaps from animal fats, etc., are chiefly used for the lubrication of industrial bearings.

The substitution of greases or semi-solid lubricants for fluid lubricants is frequently a much-discussed question among industrial engineers. As a point of information it is safe to say that grease should be used:

1. Where the oil cannot be retained within the bearing clearance space on account of high operating temperatures, pressures, or slow-rubbing speeds.

2. Where any liability of oil drips or splash might involve damage to belting or other materials.

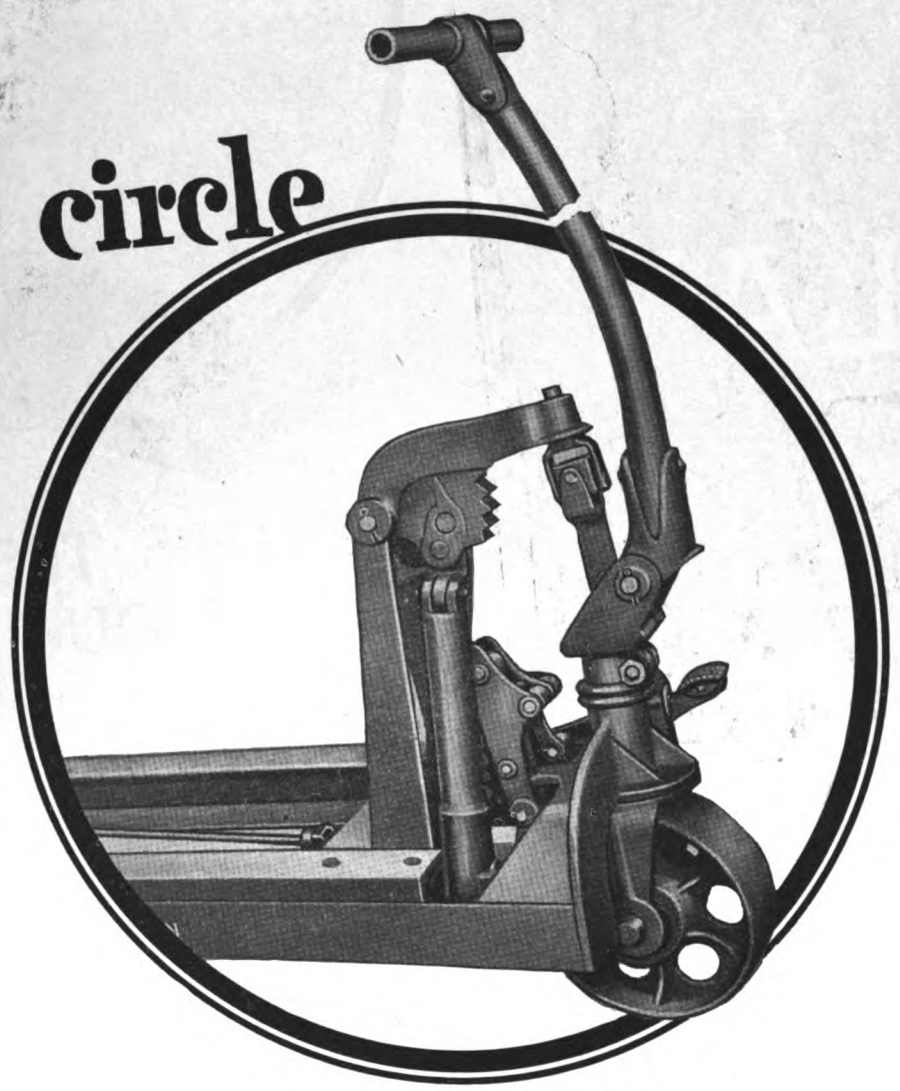
3. Where the bearing is subjected to repeated shocks, as on the automobile chassis, which might break the lubricating film.

4. Where positive lubrication is desired, using as little lubricant as possible, but with still sufficient reserve to enable the bearings to operate with little or no attention for a considerable period of time. Inaccessible bearings where grease cups are in use, and where oiling would require the shutting down of the machine for lubrication, are typical examples.

5. Where higher operating temperatures are involved

(*Continued on page 82*)

it's all in the circle



Note the space between handle and load. (Every Lift Truck, except JACKLIFT, has such lost space.) JACKLIFT takes advantage of this space to put in the dependable Jack with large, strong, easily accessible parts. A Jack is the oldest and most reliable means for lifting loads easily. JACKLIFTS elevate 8000 lbs. as easily as 2500 lbs. Their simple, rugged parts permit an easier lift, higher lift, a lift in less space (handle to the side), and the absolutely vertical lift. These are not generalities. They are proven superiorities of JACKLIFT,—the Master Elevating Truck.



Worm drive operating in oil bath. No exposed gears. A remarkable advance over all Portable Elevators yet produced. Observe that handle swings to side and reduces operating space.

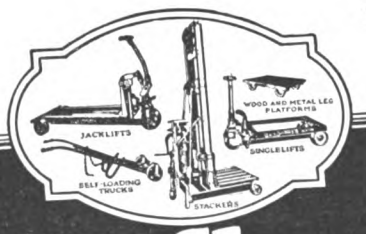
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Unit heaters occupy little floor space and can be installed in a few hours without disturbing other equipment. They are readily portable and can be moved about as needed.

The fan can be idle or run at varying speeds, thus making the heater adaptable to any kind of weather. They give a thoroughness of circulation impossible with ordinary steam coils. Our descriptive bulletin will tell you how to save your heating dollars. May we send it?

(345)

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(*Continued from page* 80)

6. Where the lubricant must "stay put" on account of its physical characteristics, regardless of whether the machine is idle or in motion.

Our Third Classification, solid lubricants, includes a number of relatively solid materials. Among these are graphite and unctious substances such as soapstone, talc, etc. Solid lubricants may be used either alone or in various combinations with fluid lubricants, such as mineral oils. For example, there are the several mixtures of graphite and oil so often used for more or less special conditions of lubrication. Solid lubricants alone, however, are seldom used for actual lubrication in industrial practice. More particularly have they been found of certain value when it has been necessary to cool down an overheated bearing. White lead and flowers of sulphur are two substances sometimes used for this purpose.

As a lubrication study, this matter of bearings and their application to industrial machinery is of especial interest, inasmuch as such machinery involves perhaps a greater variety of types of bearings and methods of lubrication than any other field of engineering. A preliminary study was made in INDUSTRY ILLUSTRATED for April, 1923, when the author discussed the various methods of lubrication and types of equipment involved, more or less in the order of their development. It can be appreciated that the application of any particular method or system will depend, of course, upon the intricacy of the machinery involved. Naturally a certain amount of knowledge concerning both lubricants and bearing construction is necessary. With this available, and a remembrance of the fact that bearings will in general carry the brunt of the burden in practically any type of machine, the question of bearing lubrication should rarely prove difficult to the average layman, provided he, of course, uses high grade, properly refined lubricants and doesn't let economy run away with common sense.



In the Richards-Wilcox Plant, Aurora, Ill.

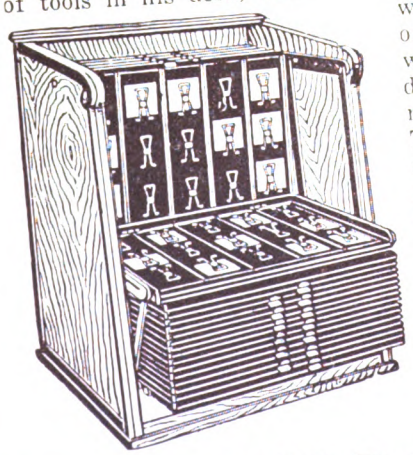
A 15% Cut in Tool Expense

Since They Installed a McCaskey

THAT'S what actually happened in the plant of the Richards-Wilcox Manufacturing Company at Aurora, Ill. But it's only one of the surprising benefits they derived from their McCaskey Register—benefits that may be yours as well. Read the others in the following letter of Mr. R. H. Bellmore, Assistant Superintendent and Production Manager:

"A reduction of over 15% in tool expense, the releasing of hundreds of dollars formerly tied up in over-stocked tools, the saving of many dollars lost in idle time and in holding up production while hunting for dies, jigs, etc., are some of the results we have accomplished in the past year with our McCaskey register.

"Now when a workman needs a new tool, a die, jig or sample he has just one place to go—our tool room. Before, each foreman kept a supply of tools in his desk, and no record was kept of who used them or when they were used. The dies and jigs had no definite place. To get anything from the tool room now, the workman must fill out a form in triplicate showing the tool, jig, die or sample drawn, the date, department and the signature of the workman. The original is filed in the McCaskey workman's register under the workman's number. A pink triplicate is filed in the McCaskey tool register under the number of the tool, and the yellow duplicate is given the workman.



Making the Workman Careful

"The workman has to account for everything charged against him in the register, and if tools are broken through his carelessness, or are lost, he has to pay for them. Naturally he is much more careful, and as a result we are buying over 15% less tools than formerly. We know too, just what tools we need and what we don't need. We used to order a large quantity of everything when we ran low. Now we order according to how fast we use the tools, and thus we are not tying up our money in slow moving stock.

"When a workman is through with a die now he brings it back to the tool room instead of throwing it down anywhere and forgetting it. We used to spend a day or two at a time looking for lost dies and jigs. That meant idle workman's time to say nothing of the loss due to held-up production. Everyone is enthusiastic about the savings we have effected through the installation of the McCaskey. And even the individual workman is more productive because McCaskey has made him more careful."

And in Your Plant—

You, too, no matter what your business may be can derive benefits of this character by installing a McCaskey System designed for your needs. It is no trouble to find out about them. Write us today.

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The purchasing agents of this country will pour into Boston during the week of May 19th, 1924, to attend the Ninth Annual Purchasing Agents' Convention and "Informashow" to be held under the auspices of the National Association of Purchasing Agents.

Here will be assembled in Boston for the first time the very men whose sole job is to buy and who are the men on whom manufacturers are concentrating their sales efforts week in and week out. And now, for an entire week, instead of the purchasing agents sitting in their offices and being visited by your salesmen, they will be here in Boston away from home and routine office cares, ready and willing to be shown whatever manufacturers have to show them. The Convention is really the manufacturer's opportunity. It is up to the producers throughout the country to show the purchasing agents why and how their products are superior and why their order blanks should bear the name of those products on the next purchase of supplies, equipment, or products of any sort.

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Two Successful Plans

By W. J. McNULTY.

T. S. SIMMS AND COMPANY, a firm which for fifty years has manufactured brushes and brooms at St. Johns, N. B., is decidedly of the opinion that a works council is beneficial to the interests of an industrial concern.

This company introduced a works council system into the plant. The first plan proved inadequate and a second plan was substituted by mutual agreement between the firm and employees. The second plan has wrought ideally to promote harmony between employer and employees. There has been no industrial trouble since the institution of the second plan. The plant has not been affected to even a minor degree by labor troubles.

Regular meetings are held in the assembly hall of the plant, these meetings being attended by employees and members of the firm including the heads of the various departments. There vexatious questions are discussed and an amiable adjustment made of each grievance. A committee composed of members of the firm and delegates selected by the employees meets regularly also, to discuss topics of mutual interest to employer and employees.

Under the works council plan as adopted by this manufacturing concern, a compensation scheme for all employees who are injured or are ill has been included. Each employee contributes a per capita assessment yearly to the general fund, and the firm contributes a like fee. The number of grievances has been reduced about sixty per cent. since the introduction of the Simms working council plan. The production of the plant has been greatly stimulated, and the efficiency of the employees has been greatly increased. The number of defective brushes and brooms is now at the veriest minimum. Wages have not unduly increased and exorbitant demands have been made on the firm by the employees, who are now manifesting deep interest in the welfare of the firm.

The Eastern Manufacturing Company, manufacturers of men's clothing and women's clothing in St. Johns, N. B., was troubled for several years by habitual and occasional tardiness on the part of employees in reaching work in the mornings, and following lunch at mid-day.

A number of employees had been discharged because of this tardiness, the late arrivals having upset the morale of the plant, as well as interfering with production. But it was found that in most of the instances where dismissals were made, competent workers were lost to the plant and these were

EUCLID

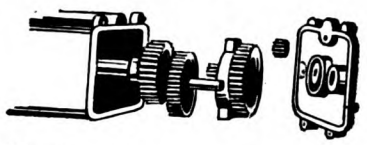
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"RAISE PROFITS"

"—AND THEN THEY TRIED A EUCLID"

EUCLID for PERMANENT PERFORMANCE

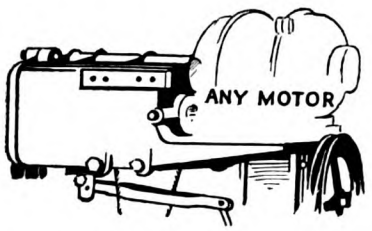
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Skilled mechanic not required.
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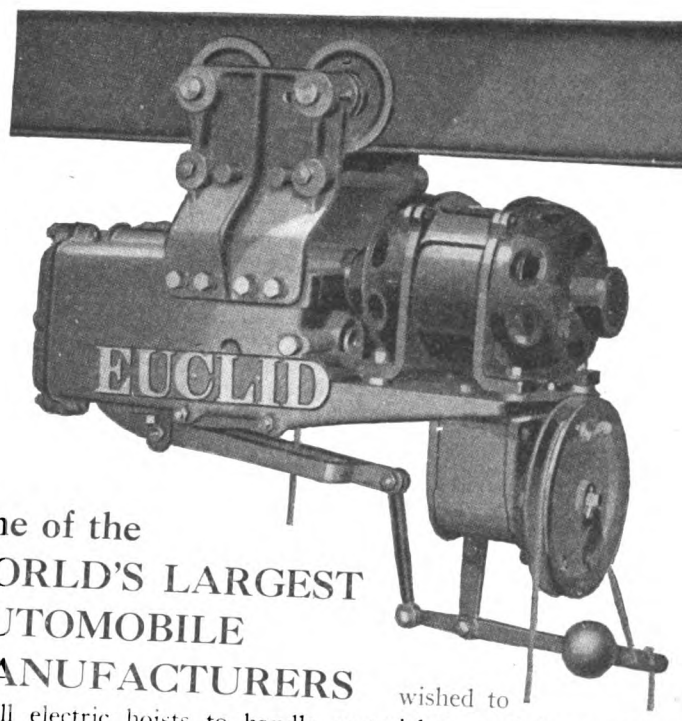


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One of the WORLD'S LARGEST AUTOMOBILE MANUFACTURERS wished to install electric hoists to handle material to and from their chain conveyors as well as to other places in the plant. The work was *continuous* and severe.

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eagerly engaged by rival concerns, who were ready to overlook the tardiness because of efficiency in other respects.

The Eastern Manufacturing Company had found its plant virtually demoralized, because of the dismissals and the necessity of replacing the skilled workers by new hands, with the attendant inefficiency for more or less extended periods, often stretching into months.

Something drastic was required to restore the production of the plant to normal status. Several plans were advanced, but each was rejected because of glaring deficiencies.

It was finally decided to start a "Be On Time Contest." Under the rules of this contest, each employee, who at the close of the month had the cleanest record in reaching work on time, would receive a cash prize of five dollars, and the second prize would amount to two dollars. The third prize would be a ticket to one of the night performances in a local theatre. In addition, it was announced as an extra incentive, that leaders in the "Be On Time Contest" would be rated high for promotion, and increase in wages.

The remedy for the tardiness was found in the contest, which is continued each month since the introduction of the plan. Tardiness has been decreased sixty-five per cent., and indications are for further improvement. Each month conditions are improving. The morale of the plant has been restored and the production has been considerably stimulated. The Eastern Manufacturing Company executives feel they now have the panacea for the tardiness evil.

AT a recent meeting of the Conference Board of Physicians in Industry in New York, some valuable hints on the use of iodine in industrial and other accidents were embodied in a recommendation which has just been made public by the physicians' organization.

"Tincture of iodine," says the statement of the physicians, "should be used only in and around the wound. It should be applied within eight hours after the injury occurs—the sooner the better.

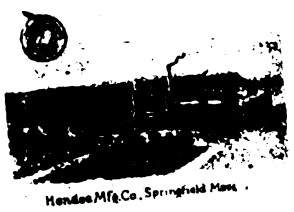
"Every skin, no matter how clean it may appear, has thousands of germs on its surface ready to poison a fresh wound before Nature can build a defense against them. If iodine is applied immediately, or a short time following the injury, these germs are destroyed before they have a chance to infect the wound. If application of iodine is delayed beyond eight hours the germs will have grown into the wound so deeply that the iodine will not reach them.

"One thorough application of iodine is enough as it has no healing properties. It should not be applied too strong, as sometimes occurs when the solution has been made stronger by leaving the cork out of the bottle and allowing the contents to evaporate.

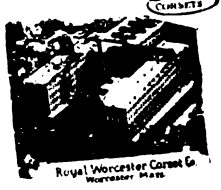
"Apply folds of gauze (bandage, not cotton) directly to the wound. Never soak the gauze in iodine as this will burn the skin. Never use tincture of iodine on unbroken skin surfaces as it frequently irritates and blisters, producing in the wound that later may be poisoned."—*National Industrial Conference Board.*

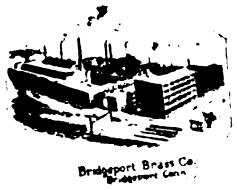
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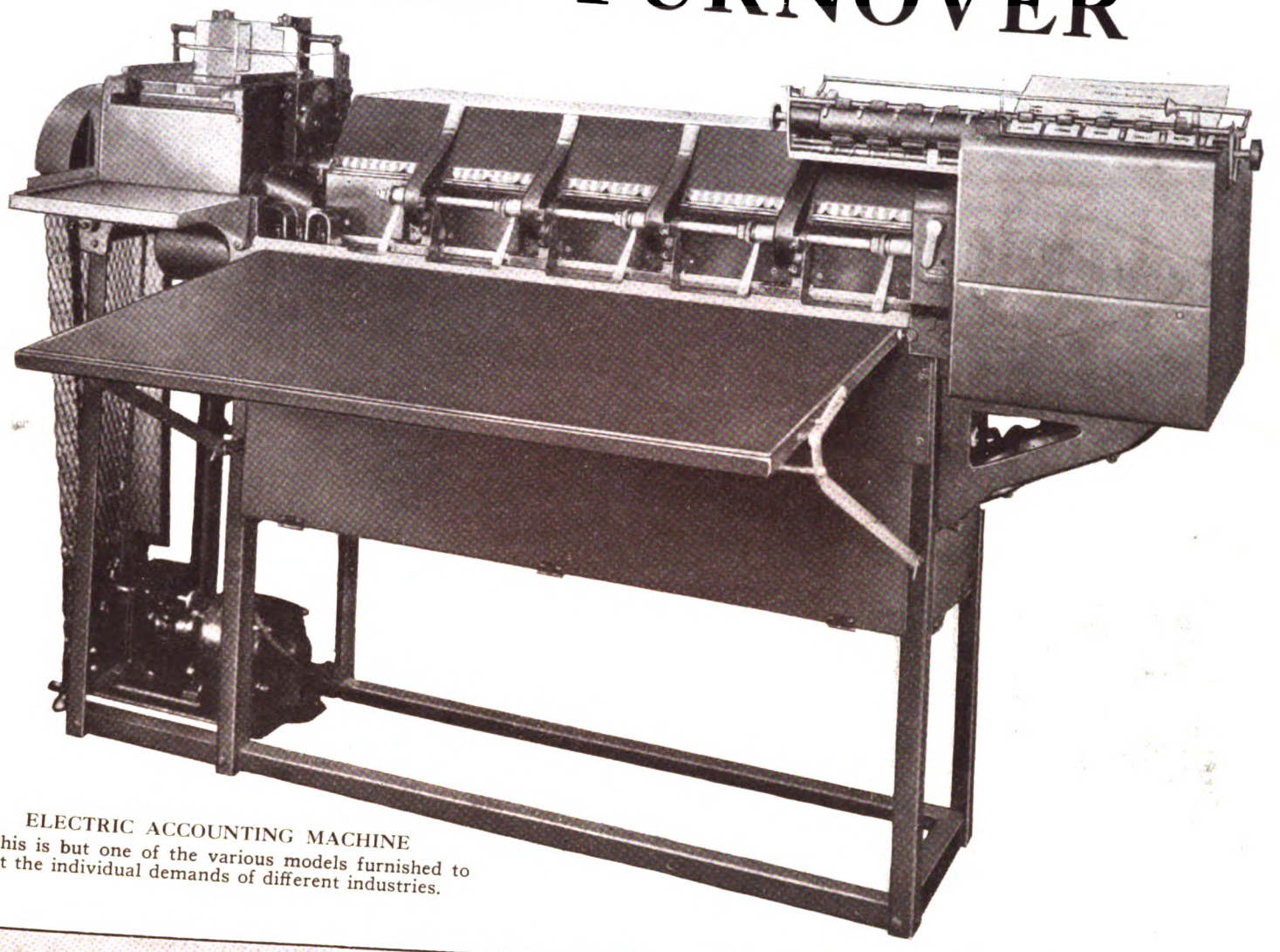
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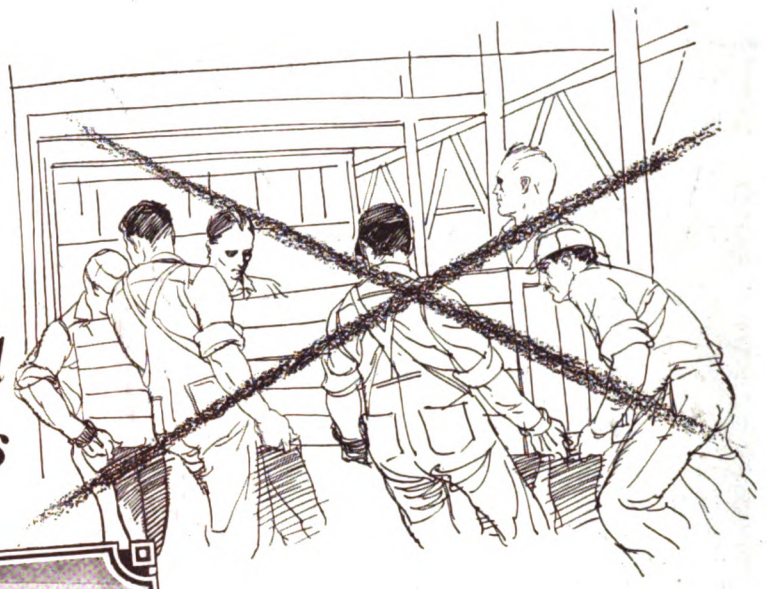
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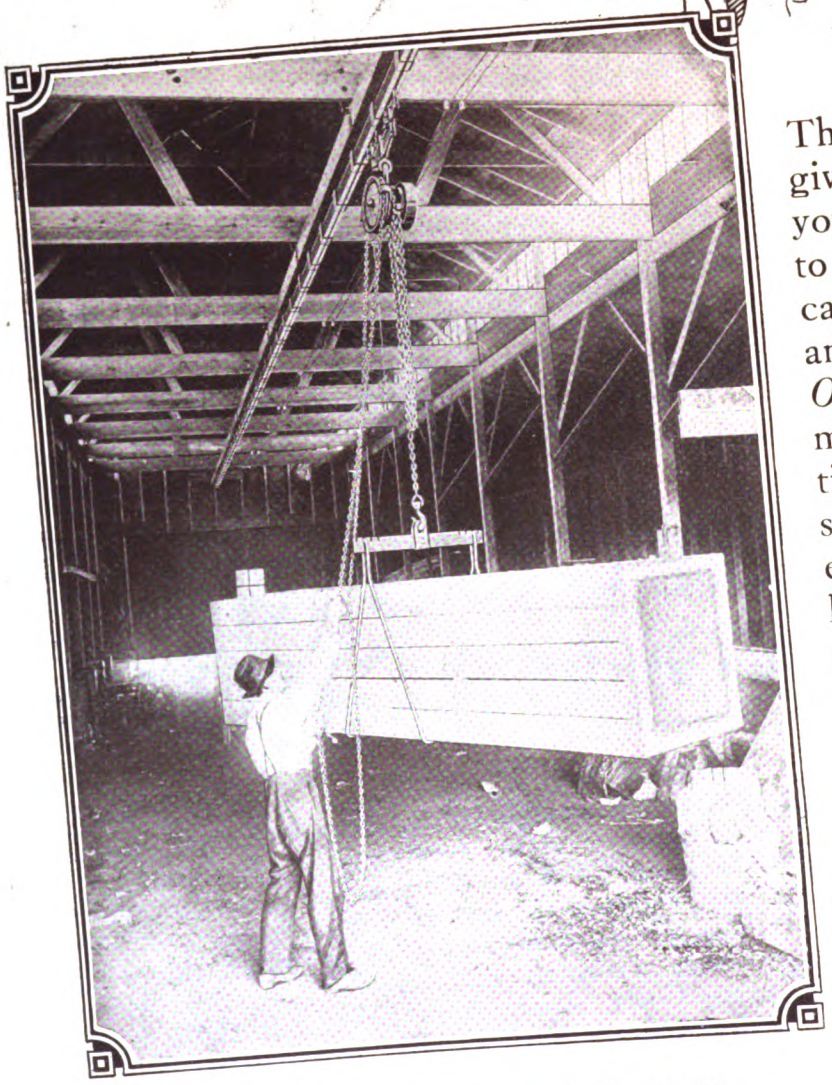
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The next time you go through your plant, give a thought to your handling costs. If you find that it takes more than one man to move a packing case, carry a heavy casting or handle a bull ladle, decide then and there to end such wasteful methods. *OveR-Way* can help you do it, for this modern means of overhead trucking is cutting handling costs in hundreds of diversified industries. It speeds production, economizes on storage space by permitting higher piling, and multiplies your man power by enabling one man to do the work of six.

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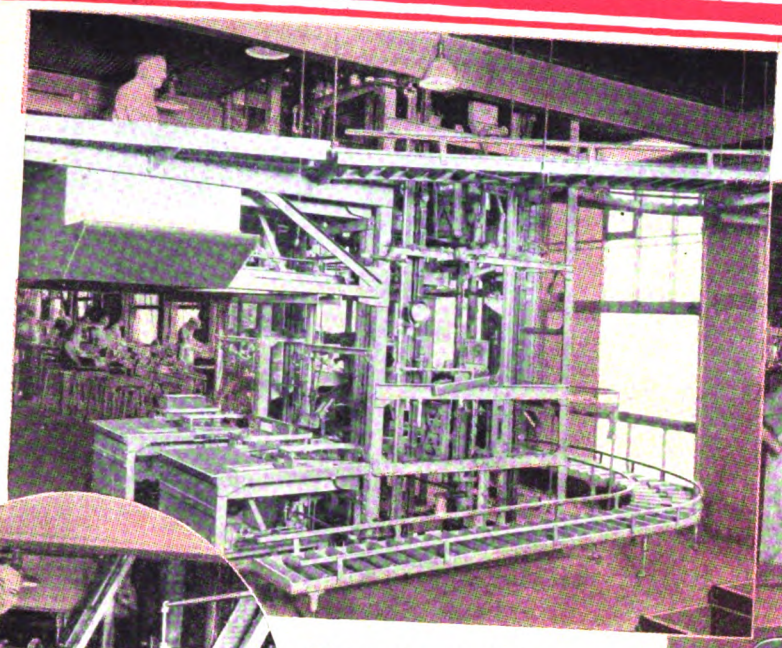
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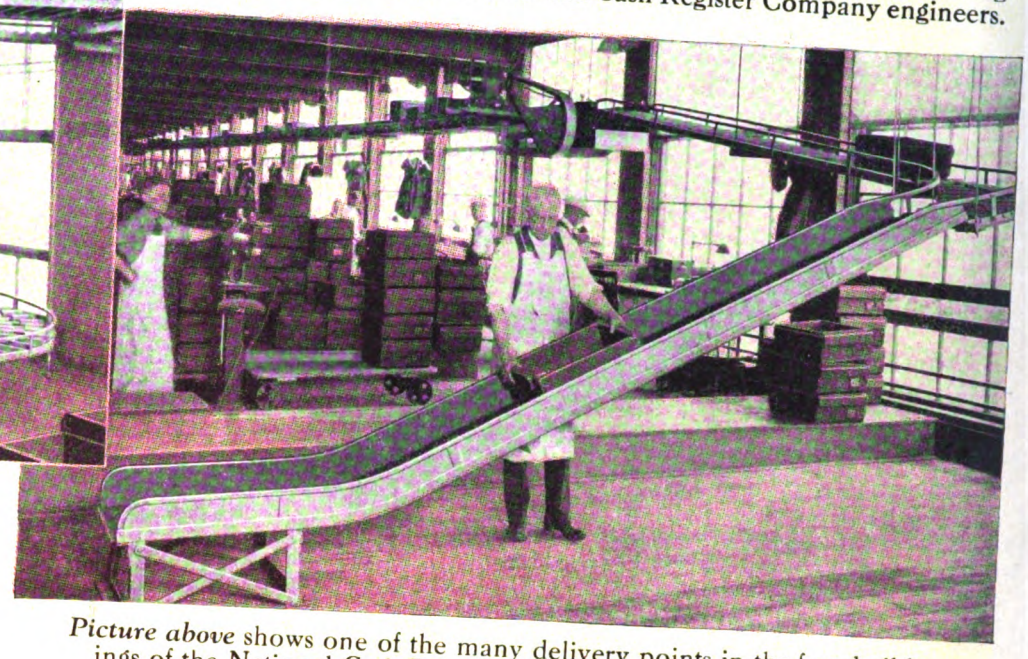
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Picture at left shows transfer point that makes system intercommunicating. This vital feature was designed by Lamson engineers, working in close cooperation with National Cash Register Company engineers.



Picture in circle shows the man in the switch tower who transfers incoming loads to the outgoing lines which carry them to their proper distinations.



Picture above shows one of the many delivery points in the four buildings of the National Cash Register Company plant. Boxes of stock are sent by conveyor over great distances, quickly and cheaply.

N.C.R. moves 2,400,000 boxes of stock a year over industrial conveyor system

THE National Cash Register Company, in their great plant at Dayton, Ohio, use a Lamson industrial conveyor system to handle practically all stock between the stock room, and the various machine departments.

This system serves four buildings, and a number of floors. It includes vertical units, and 1¼ miles of belt conveyor.

A central transfer point makes the system entirely intercommunicating. Boxes coming into this point from all departments, are transferred to the outgoing lines that carry them to their proper destinations.

The savings made by this system are great. Stock is delivered quicker and more uniformly. The congestion on floors is relieved. Stocks of finished materials are reduced. Workmen have the incentive of seeing stock continually on the move.

Whether it be an extensive system like that installed in the National Cash Register plant, or a small system for limited service, modern Lamson material handling equipment makes savings out of all proportion to its cost.

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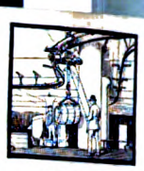

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Precision of control is one of its outstanding features. Loads of various kinds can be accurately and safely lowered into position—the operator has complete control.

Standardized manufacture and quantity production make the *LiftAbout* low in price.

THE SHEPARD ELE SINGLE I-BEAM C

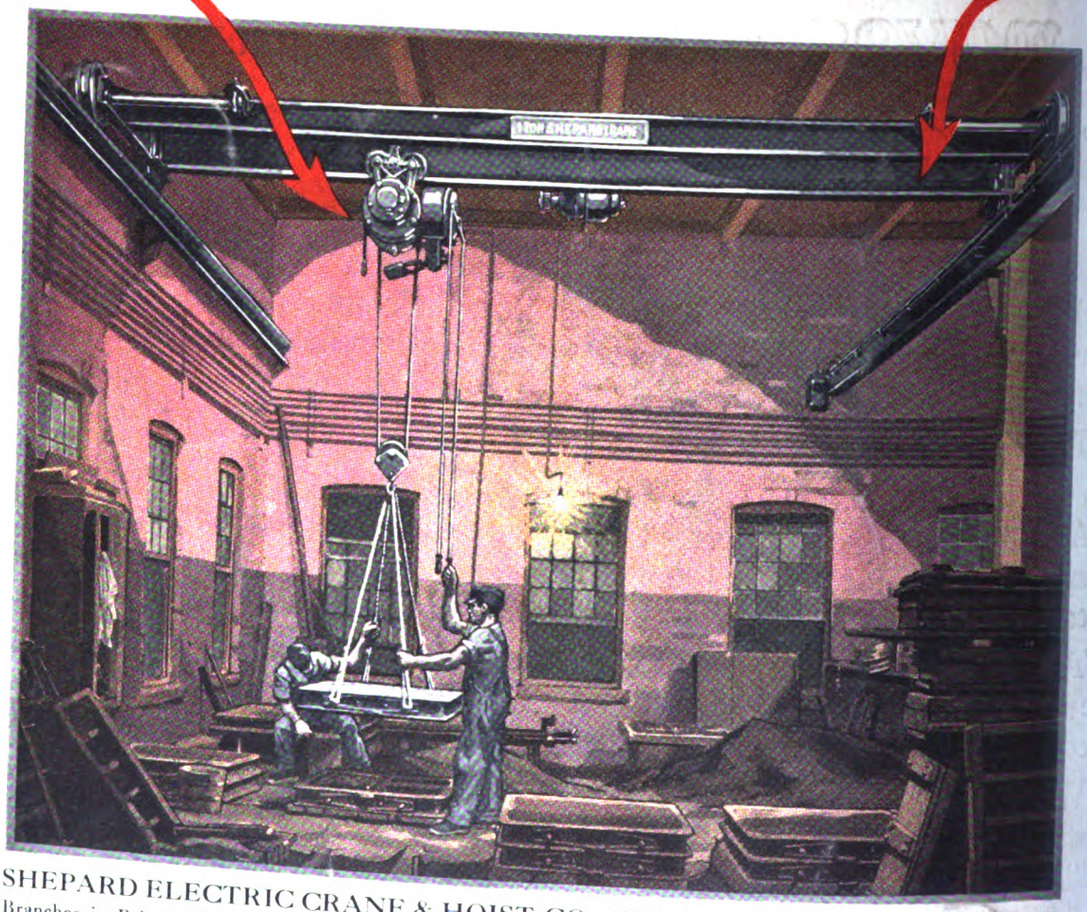
Lifting facilities at every point on The crane operating on its runv length, the *LiftAbout* operating on t the width.

With this combination, many plan unusual economies, because one o speedily take care of the work that a "gang" to accomplish.

Investigate this combination—it is and can be used for many purposes.

Write for

the "Book of Illustrated Economies." It gives facts and figures of *LiftAbout* savings in many industries. It describes many of the *LiftAbout* installations pictured at the top and bottom of this page.



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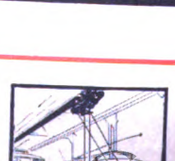
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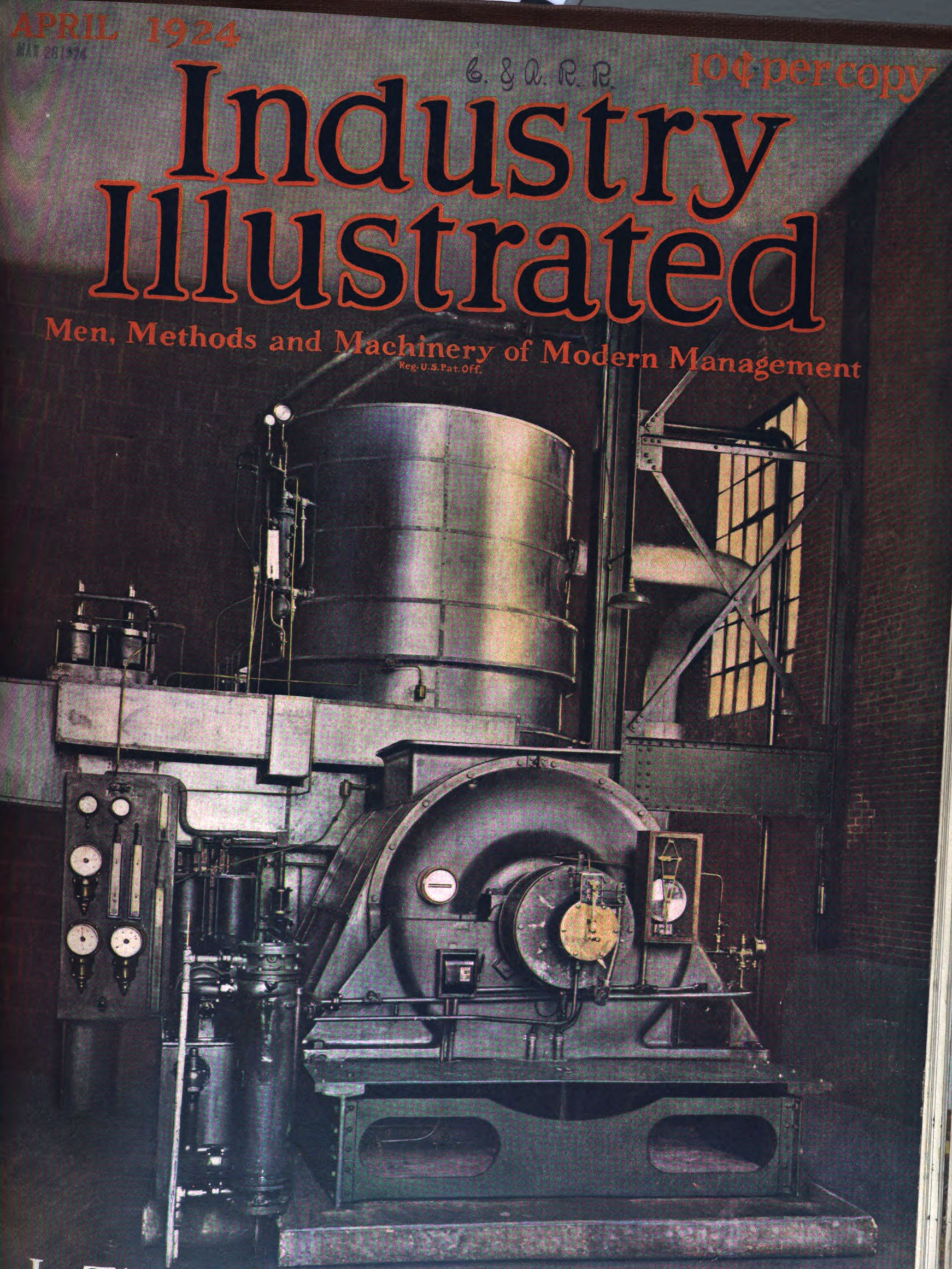
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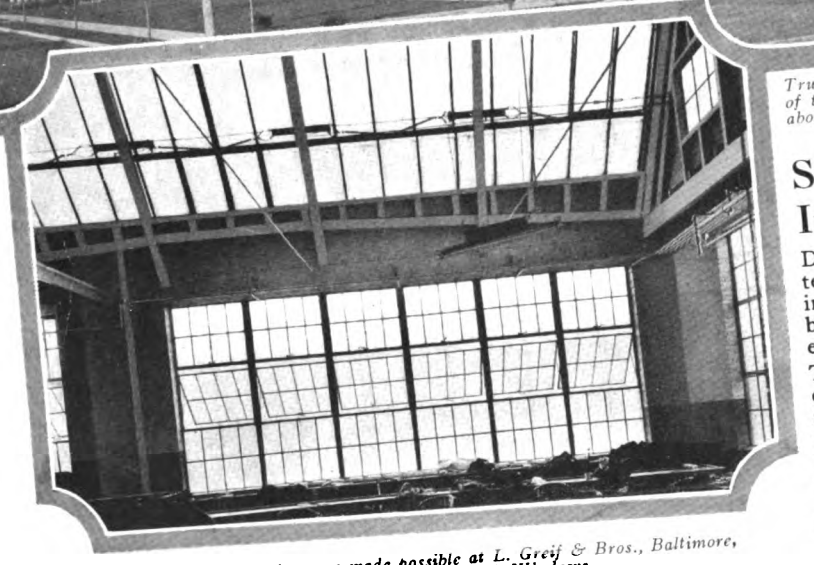


In This Issue — The Mercury Boiler

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Truscon Steel Windows used throughout the plant of the Narrow Fabric Co., Reading, Pa., illustrated above—constructed by Stone & Webster, Inc.



Ideal working conditions are made possible at L. Greif & Bros., Baltimore, Md., through Truscon Steel Windows

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Daylight, good ventilation and fire protection are too valuable to overlook in the industrial field. The nature of many businesses makes these factors absolutely essential to their successful operation.

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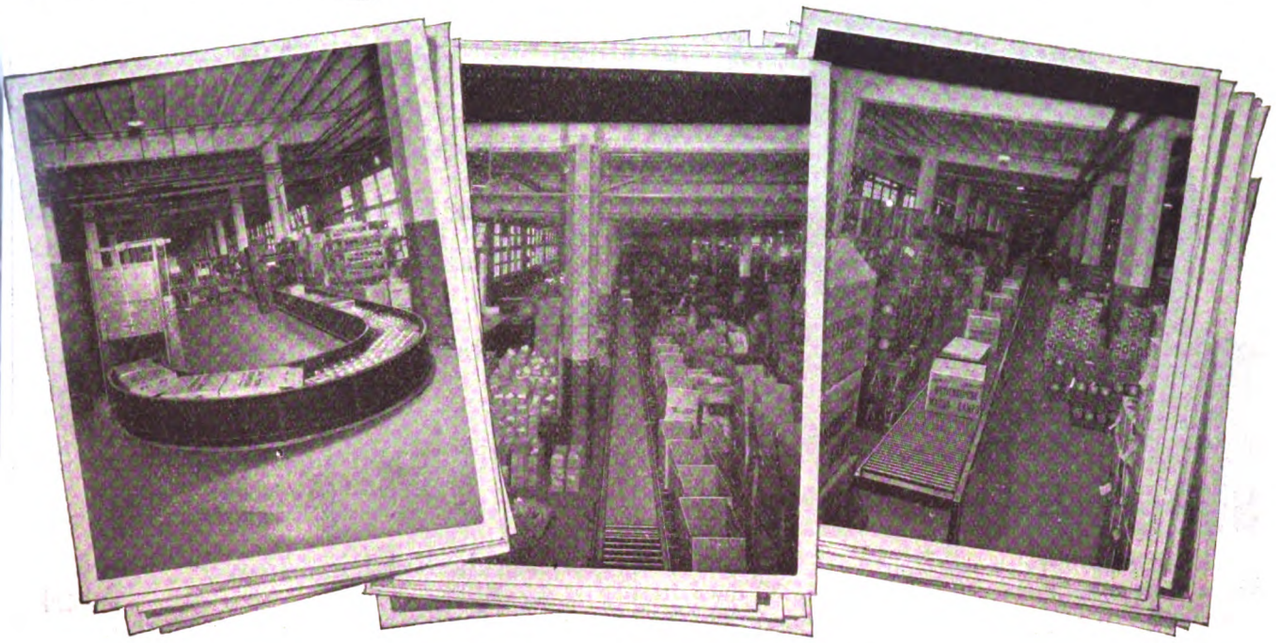
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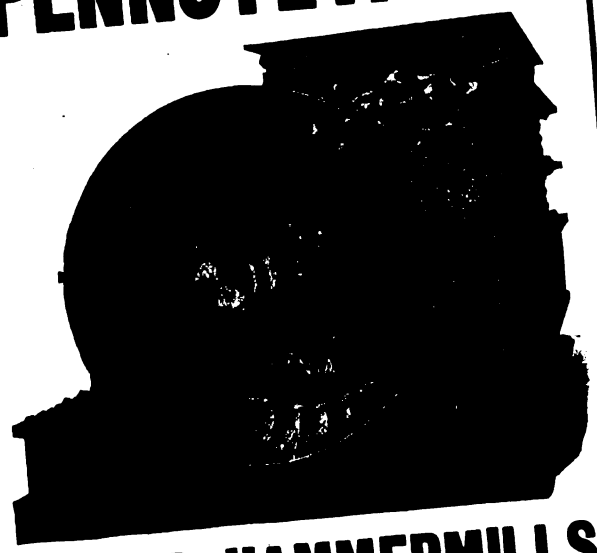
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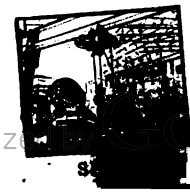
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1—A Barber-Greene Conveyor, with cleated belt, handles lump coal at the J. S. Davis Coal Co., Toledo, Ohio, storing it well back from the tracks. It unloads a car of mine run in an hour.



2—Before the Miamisburg Light, Heat & Power Co. bought this Barber-Greene, there was demurrage on one or two cars out of every three received. There has been no demurrage since.

3—A Barber-Greene Conveyor stores coal at the Miamisburg Paper Co., two conveyors being used to reclaim to a bucket elevator. A car is unloaded in one hour.







4—The Barber-Greene which unloads a 50-ton car of Shamrock 4-inch lump in 59 minutes. It has eliminated storage bins near the tracks, and has increased the storage capacity of a limited area.

5—Showing Barber-Greene equipment in use at a large plant. Cars are unloaded to the conveyor, which stores at the rate of a car an hour. A Barber-Greene Loader reclaims the coal.

Stopping demurrage with Barber-Greenes

Unloading a 50-ton car of 4-inch lump in 59 minutes, a Barber-Greene Conveyor has solved more than one problem for Grove & Weber, Inc., of Miamisburg, Ohio.

It has done away with all demurrage, and eliminated a large "floating gang" of workmen. The storage bins which were formerly required near the tracks, have been discarded. The Barber-Greene conveys the coal well back, greatly increasing the storage capacity of a limited ground area.

For every three carloads of coal delivered to the Miamisburg Light, Heat & Power Company, there was demurrage on one, and often two cars. Unloading and storing a car in an hour, a single Barber-Greene has eliminated this demurrage. Storing and reclaiming are now done by the boiler room force of two men.

At the J. S. Davis Coal Company of Dayton, Ohio, Barber-Greenes are preventing demurrage which had amounted to $600 to $800 each year. Photograph No. 1 shows how one of these conveyors, with cleated belt, handles lump coal, storing it back away from the track.

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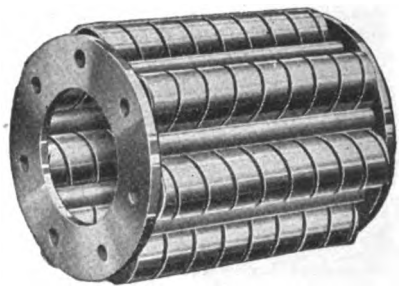
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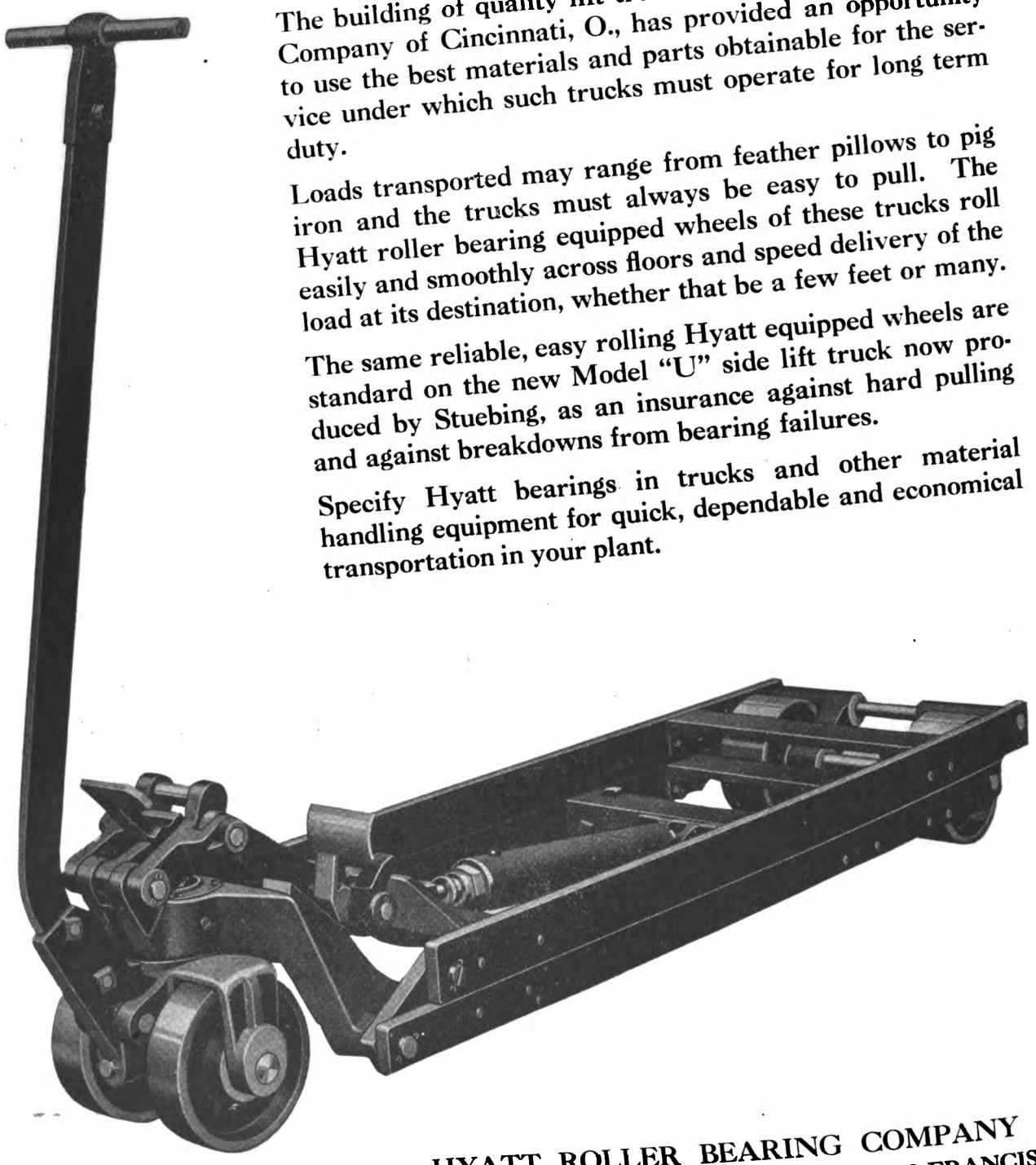
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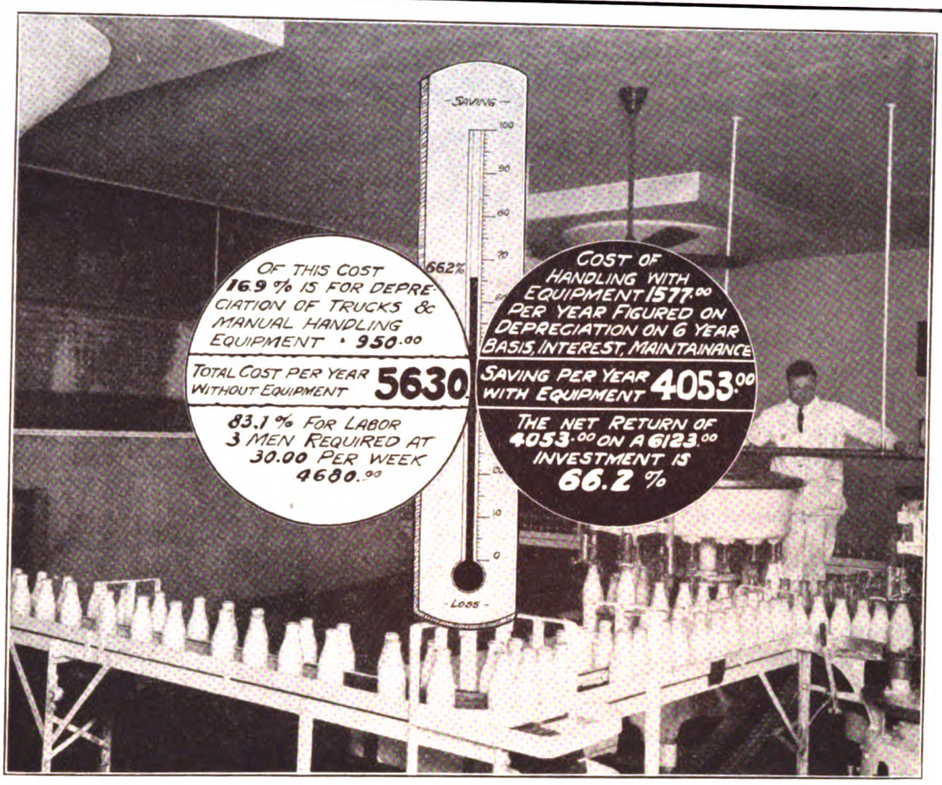
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To or For { A Foreman, A Superintendent, A General Manager, A Treasurer, A President } *and for his Company*

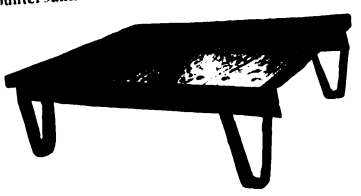
Try it. Many progressive men who are working with the interest of their Company at heart, continue year by year along a definite path with their attention focused on specific phases, and allow opportunity after opportunity to make savings (stop losses) to go by, simply because they have not asked themselves the following question—"CAN'T I IN SOME WAY CUT DOWN THE EXPENSE OF HANDLING, REHANDLING AND RE-HANDLING MY MATERIALS?" The answer is so evident that the tendency is to simply do any one of a number of things; such as buy this, or buy that; or try out this, or that. Carry this SELF ANALYSIS further and ask yourself—"DO I WANT THE GREATEST POSSIBLE SAVING?" The answer is "Yes." Right here we believe you will agree with us in diagnosing a physical ailment, you consult a diagnostician and get the best specialist you can find to prescribe the remedy.

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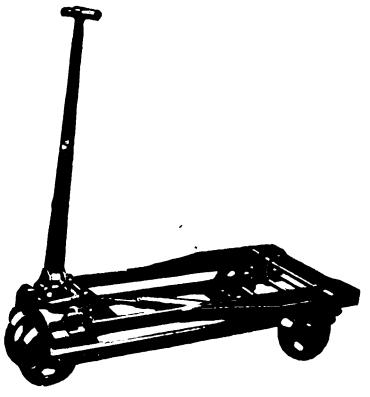
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COWAN Long Life Skids have built into them long life, low maintenance and the ability to stand up. These features are accomplished through the use of certified malleable iron feet, riveted to the side flanges of Commercial angle iron and bolted through the top flanges of this angle to the best grade of wood decking. Oversized flat headed bolts are used and decking is countersunk so top surface is flush.



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The study of our customers' problems has actuated the careful thought put into the design and workmanship of COWAN trucks and is the reason why COWAN is the largest manufacturer of Hand and Electric Lift Trucks in the world.



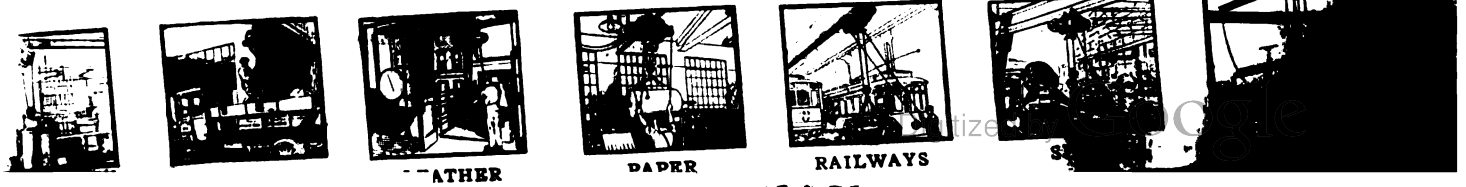
COWAN Model LLT Electric Elevating Machines (TRUCKS) have by actual test super qualities such as simplicity, strength, flexibility, ease of control. Many of the difficulties that have been experienced in electric industrial truck design have been eliminated in this new COWAN Model LLT.

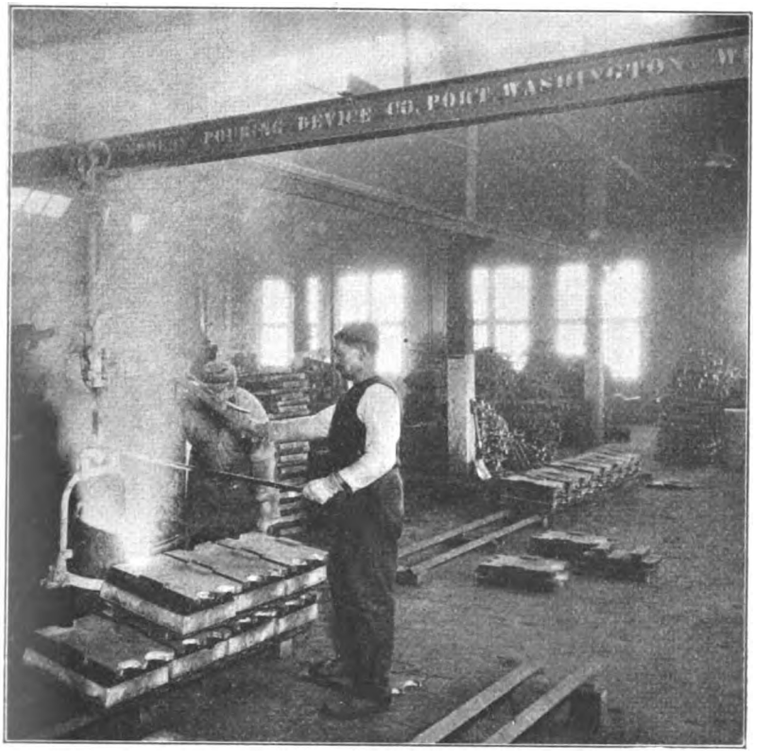


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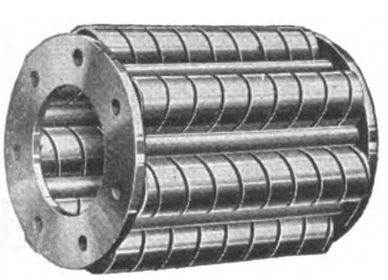
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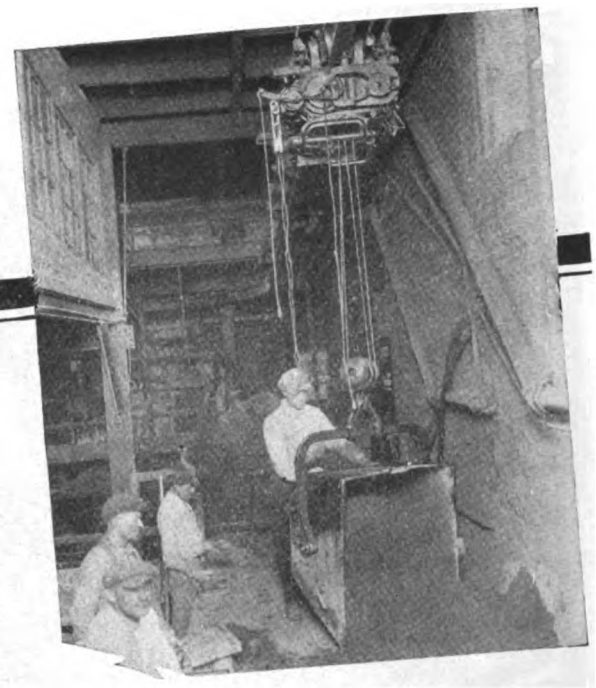


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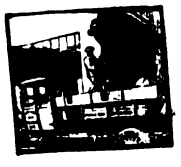
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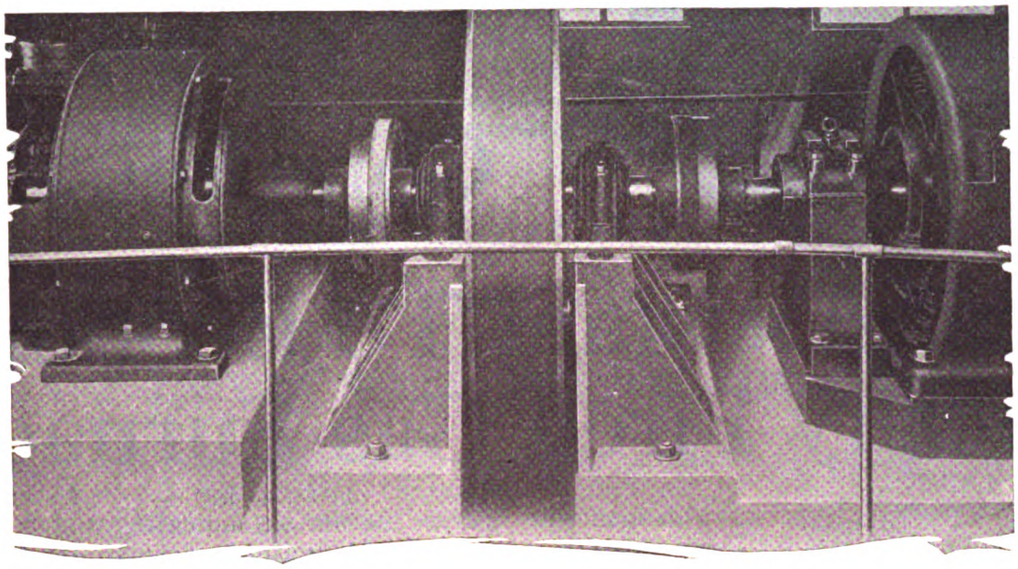


RAILWAYS





SKF



Ball Bearing Flywheel in Australian Mine Raises Lift Four Times With Power Off

IN far off Australia, 182-horse power was required in this mine at Rutherglen, Victoria, to raise a loaded lift. The problem was solved by one 40 H.P. motor and one 130 K.W. generator, with a five ton flywheel running between the generator unit on Skayef self-aligning ball bearings to operate mine lift.

Enough energy is stored by this six-foot flywheel, operating at 1000 R.P.M., to enable 182 H. P. to be taken from the generator, meeting all requirements.

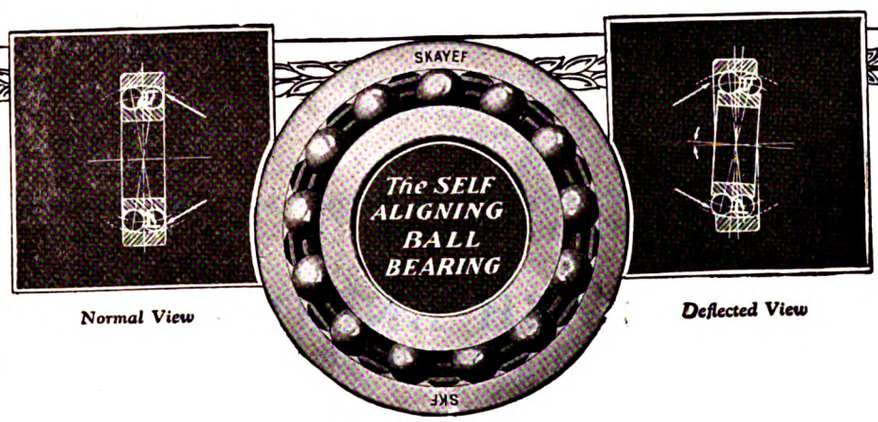
In addition, when power is shut off, sufficient energy is stored up in the flywheel to raise the lift four times, proving friction is a negligible factor in Skayef self-aligning ball bearings.

Although your requirements may not be as exacting as in this Australian mine, where bearing failures would prove serious, causing costly shutdowns, SKF marked ball bearings will give you the same degree of dependable service at all times.

THE SKAYEF BALL BEARING COMPANY

Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

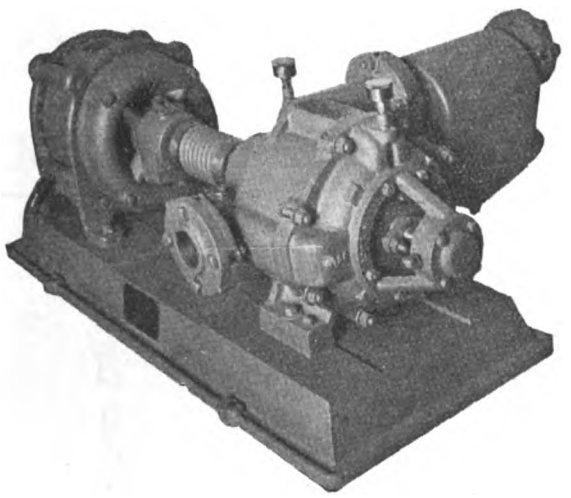
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←THIS is a graph with movable rotor which shows exactly the operating principle of Nash Hytor Compressors. With it you can see that the Hytor Compressor is valveless, has no gears, loose moving or reciprocating parts. No piston packing to renew, no cylinders to lubricate and no bearing adjustments to make. These things all make for long life and low cost maintenance in addition to economically fired gas furnaces.

We shall be glad to send you this graph and full descriptive data.

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Editorial

The Lever that Moves the World

NOT many centuries ago, the larger part of our world was unknown and uncharted. Then came the age of exploration, when bold men started on hazardous journeys, little knowing how or where they would end. The strange lands which these pioneers discovered were looked upon, by themselves and their fellow countrymen, as "new worlds"—the natives of these strange lands as "new peoples."

But they were not new, except to their finders. Columbus did not reveal a new world, he discovered an old one that had existed since before the days of Abraham. The ultra modern island of Manhattan—minus its skyscrapers and hurrying footsteps—had its being when Adam was young. The big geographical changes were completed before man's time. Since man's time, continents, islands, mountains and rivers—"old as the hills"—have patiently, through centuries of time, awaited man's coming—awaited not merely savage man's coming but the coming of intellectual man with his ability to utilize them.

There is nothing new under the sun.

Everything that we have today and everything that we shall have tomorrow has had potential existence since the beginning of the world. The motor car was present in the Garden of Eden. Adam did not see it, for it was invisible to his intellectual vision. It was there, nevertheless, hidden in the bosom of the earth, in the iron ore, in the sand and limestone, in the rubber trees. The aeroplane was there, as was the electric motor, the steam turbine and the radio. All of the miracles of modern science and invention were there in the form of the fewer than one hundred chemical elements whose combinations comprise and form the world, the life and the tools of mankind. All of the fruits of science and invention were there but all awaited the growth of human intelligence and intellectual vision sufficient to make them visible.

It may be that if Adam had not eaten of the famous apple, mankind might have blossomed in its youth into full intellectual maturity and been blessed with such omnipotent vision, as to summon instantly all of the wonderful things which have been bought since at the expense of so much pain and toil. As it is, we are still far from intellectual maturity. Our knowledge is dearly bought. Our discoveries are painfully slow. It has taken us thousands of years to find the steam engine. It may take us thousands of years more before we discover in nature's storehouse the apparatus which is awaiting us there and which will enable us to utilize directly the power of the sun.

Mankind still resembles children playing in a great house in which are many mysterious locked doors. At intervals a child finds a key which unlocks one of the doors and reveals a new and entrancing toy. The child's delight is like that of the inventor who has discovered a mechanism new to him and his fellow men. But the toy was there all the time, and the newly discovered mechanism is not *new*. Both awaited the finding of the proper keys.

The keys to these hidden doors are *ideas*. Ideas are the keys that unlock the doors of progress, the levers that move the world. Somewhere there is a door for *you* to unlock, behind which lies success, recognition and progress. But before you find it you will have to pick up and try many, many keys.

Every picture in this publication contains an *idea*—a key to some hidden door. The keys are not all new—perhaps you have tried many of them. But do not fail to search for the one that you have not tried. Perhaps it may be the key to your treasure house!

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Pioneers of Power

The Men Who Made Modern Industry Possible

By James T. Beard, 2nd

IF we could look back through the centuries to the beginning of the Christian Era, and before, and see the activities, commercial and industrial, as they were carried on in those ancient and bygone days, we would behold massive structures and gigantic engineering feats performed, which we marvel at even today. And, if we looked further to see what mechanical or other power assisted those ancients in the conduct of their wonderful operations, we might see a motley array of oxen, camels, ropes, pulleys, levers of all sorts; man power, animal power, and a few simple mechanical contraptions for the application of such power to best advantage.

Likewise delving into the writing of those former days of the past, we can find no mention of the development of power, as we know it, by means of the pressure or energy in vapors or gases. With the exception of a few mechanical toys, the possibilities of engines in the performance of useful work were still undiscovered.

And as we look toward modern times, with our large condensing steam engines, gigantic turbines and ponderous boilers, we realize that all this development, this harnessing of heat energy derived from the earth, is a product of comparatively recent times.

The principles, however, upon which our modern prime movers are designed were more or less known to those early scholars, long before their practical application to the development of power was accomplished. This is particularly true of many of the basic properties of steam. The development and use of steam for industrial power purposes, therefore, has a long and interesting history.

Steam power, as it is known today, is the result of the composite efforts and inventive genius of many brilliant minds, reaching back through the centuries and having its beginnings considerably before the Christian Era. Just when the principle of the expansive force in steam was first discov-



Fig. 1. James Watt foresaw the possibilities of steam operated engines more than one hundred and fifty years ago. We are indebted to Watt for starting us in the right direction and to his energy and inventive genius for the impetus which he gave to the progress and development of the primitive steam engines of his day.

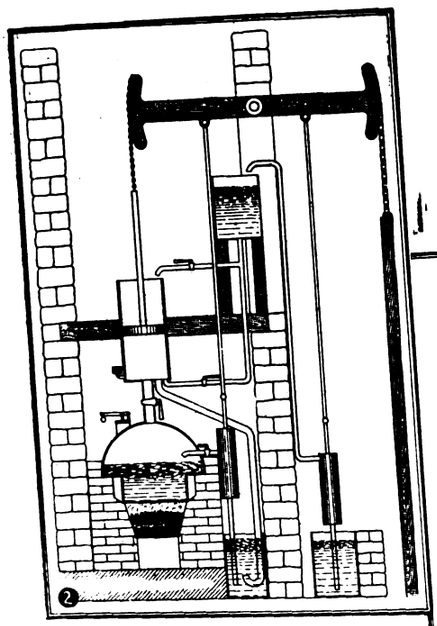


Fig. 2. The original Newcomen engine was used in Watt's time for pumping water out of the mines at Cornwall. Steam entered the cylinder at the bottom and forced the piston upward. The supply was then shut off and water was turned into the cylinder to condense the steam. The partial vacuum formed sucked the piston back to its original position.

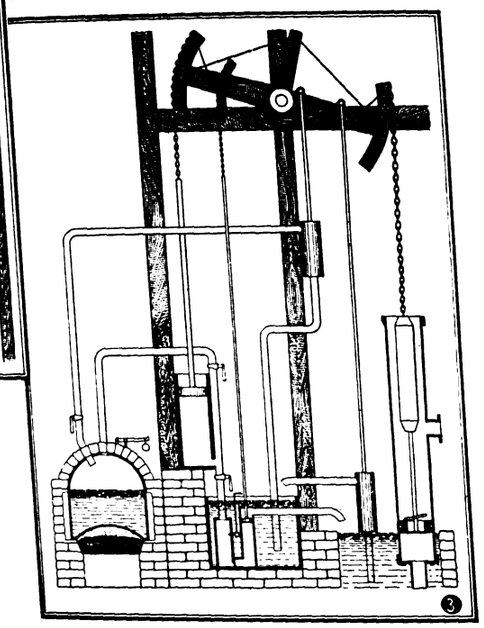


Fig. 3. Watt realized the wastefulness of alternately heating and cooling the engine cylinder and designed an early engine in which he provided a separate chamber for condensing the steam. Watt's improved engine gradually replaced the old Newcomen engine at the Cornwall mines.



Fig. 4. George H. Corliss set another landmark in the history of progress in steam engineering when he invented and applied his famous valve gear to the steam engine of his day. His invention was the first practical step toward governing an engine by adjusting the cut-off.

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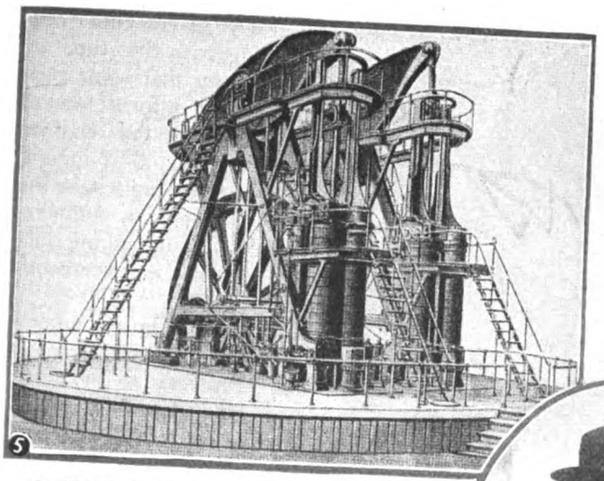


Fig. 5. At the American Centennial Exposition in 1876, Mr. Corliss exhibited his now famous Corliss Centennial Engine. This was a 1,400 horsepower unit and was considered the marvel of the day.

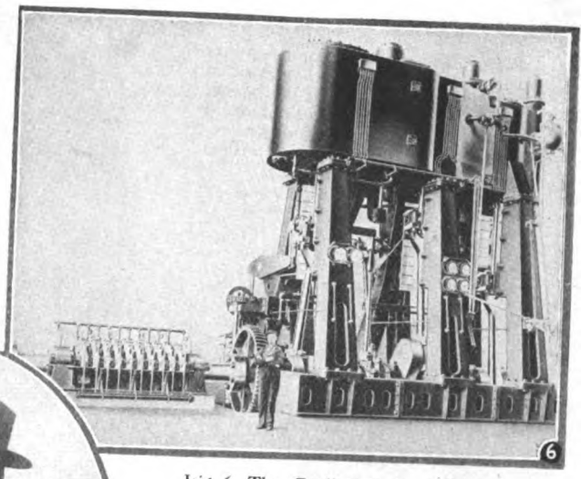
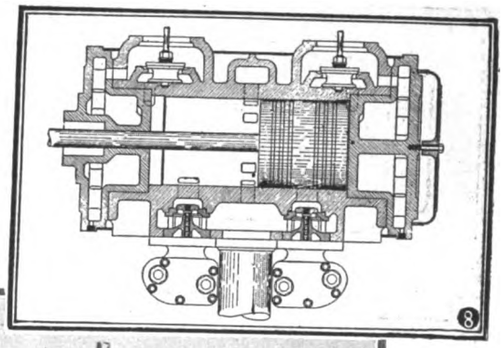


Fig. 6. The Corliss engine today is recognized as a most efficient prime mover and is found in many industrial power plants. The vertical unit shown here is a marine type of Corliss engine, in which service it has also proved its worth and adaptability.



Fig. 7. Prof. Johann Stumpf is one of the outstanding figures in the steam engineering field today. In his uniflow engine he has applied the principle of uni-directional flow and has thereby practically eliminated condensation losses in the cylinder due to alternate heating and cooling by live and exhaust steam.

Fig. 8. The uniflow engine cylinder is longer than the cylinder of a counter-flow engine. Steam is admitted at either end and during expansion flows to the mid-point of the cylinder, where it exhausts when the piston uncovers the exhaust ports.



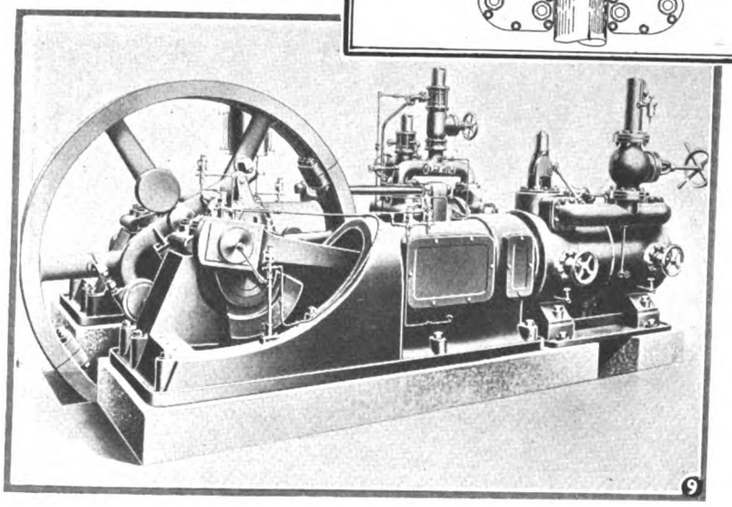


Fig. 9. The uniflow engine is not much different in appearance from the counter-flow engine, with the exception of its elongated cylinder. The illustration shows a uniflow poppet valve steam engine direct connected to a horizontal double acting compressor.

ered, no one can say. Records show that such knowledge existed earlier than 150 B. C. A treatise written by Hero, of Alexander, describes earlier and contemporary devices for employing the expansive force of steam for the purpose of raising water from one level to another. He describes, among others, a device which we known as the Hero turbine. This consisted of a vessel for evaporating water, upon which was mounted a rotating drum, provided with spouts on opposite sides for the release of the steam generated. The steam issuing from these spouts produced a "kick" that caused the drum to revolve. In this mechanical toy the principle of the present day reaction turbine was first employed. But it was just a toy and was never put to any practical commercial use until nearly two thousand years later.

It is not the purpose of this article to point out each step in the path of progress and development in the steam engineering field from the Hero turbine to the present day. To do so would require volumes. All we can hope to do here is to indicate the high spots and to point out one or two of the outstanding characters who were responsible for basic and fundamental developments in the principal branches of steam engineering, as we know it.

Although the knowledge of the expansive force of steam existed more than two thousand years ago, there was no material progress in the practical application of that principle to mechanical devices for the purpose of doing useful work until the late six-

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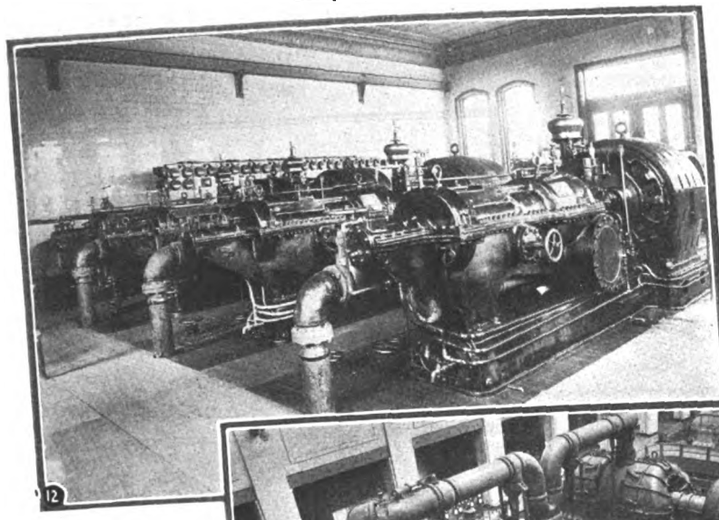
Fig. 10. The Hero turbine was a mechanical toy, utilizing the reaction principle for causing rotation. Steam issuing from the spouts produced a "kick" which caused the drum to revolve. This device was described by Hero as early as 150 B. C.





Fig. 11. Sir Charles A. Parsons was one of the outstanding figures of importance in the development of the reaction steam turbine as we know it today. Although his activities were carried on in England, these turbines are now in wide use in this country and are especially economical in large sizes and high speeds.

Fig. 12. The early types of Parsons' reaction turbines installed in this country are typified by the Westinghouse steam turbine generator units, installed in 1898 at the Westinghouse Air Brake Company.



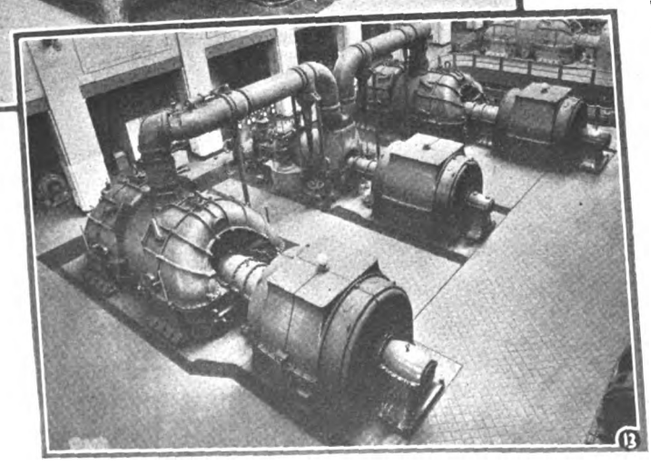


Fig. 13. The modern Parsons reaction turbine is a very efficient generating machine. The illustration shows a 72,500 kva. compound unit installed at the Duquesne Light Company, Cheswich, Pa.

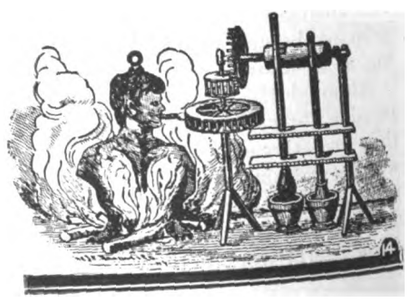
teenth and early seventeenth centuries. Beginning with that time we find records showing that some men were devoting their efforts toward producing steam operated engines which were capable of pumping water. These efforts resulted in the eventual development of a commercially successful pumping engine during the latter part of the seventeenth century.

The outstanding figure among these early inventors, of course, is James Watt. Previous to his time, the best type of engine was the famous Newcomen engine, which was used for pumping water out of the mines at Cornwall, England. This engine was a very crude, slow-working contraption. It operated on a steam pressure only slightly above atmosphere. Steam was admitted to the bottom of a single-acting vertical cylinder, forcing the piston upward. When the piston reached the top, the steam was shut off and cold water was turned into the cylinder. This cooling action condensed the steam in the cylinder and formed a partial vacuum, which sucked the piston downward again to the bottom of its stroke. The cycle was then repeated.

Watt was called upon to repair this engine in 1764 and became interested in it because of many of its shortcomings. He was convinced that an excessive amount of steam was being lost by the alternate heating and cooling of the cylinder and his first attempt at improvement consisted of the use of a separate chamber for the condensing of the steam.

In the course of his experiments he developed the "double-acting" principle in a steam engine, *i. e.*, steam was admitted alternately to each end of the cylinder. This eliminated the

Fig. 14. The Branca turbine, known in the seventeenth century in the form of a mechanical toy, is the first instance of using the impulse principle to produce rotation or rotary motion. The step between this and the present-day impulse turbine is tremendous and has taken nearly 400 years to realize.



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Fig. 15. Charles Gordon Curtis was an American. He studied at Columbia University and later became interested in the possibilities of the impulse principle as applied to steam turbines. Curtis turbines today have a wide distribution both in central stations and industrial plants of the United States.

time required before the engine could make a return stroke and increased the speed of the engine.

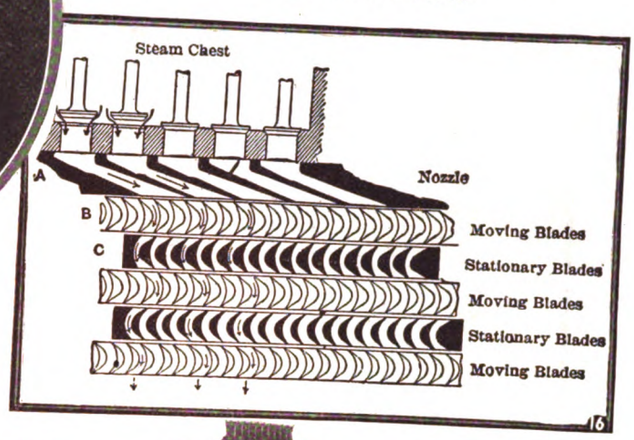
Watt must have been a genius. His originality of conception, as shown by the long list of radical improvements credited to him, is little short of marvelous. Ideas developed by him are embodied in our modern engines today.

His greatest accomplishment was undoubtedly the practical application of the expansive force of steam to a steam engine. Previous types of engines had used steam at full pressure during the entire stroke. Watt conceived the idea of cutting off the steam supply at a fraction of the stroke and allowing it to push the piston forward the rest of the stroke by its expansion.

Previous to the successful application of this idea, however, he found it necessary to equip his engine with a flywheel so that the energy stored in the wheel during the first part of the stroke would keep the engine speed fairly constant the rest of the stroke. To do this he invented the crank and connecting rod for converting rectilinear motion into circular motion.

Watt's inventions pointed the way to the possibilities that lay in the steam engine as an economical prime mover. Under his supervision it had graduated from the steam pump

Fig. 16. Steam is admitted to a turbine through suitable nozzles, and imparts its energy successively to a series of moving blades mounted upon a revolving drum. Between each two rows of moving blades are stationary blades for the purpose of reversing the direction of steam flow before it passes to the next series of blades.



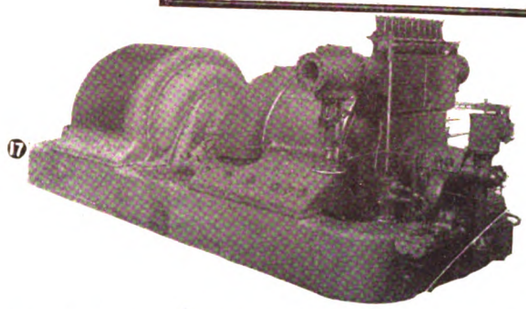


Fig. 17. A modern 7,500 kw., 2,300-volt Curtis turbine, designed for a speed of 1,800 r.p.m.



Fig. 18. William Le Roy Emmet, whose recent successful operation of an experimental mercury boiler plant of his own design at the Hartford Electric Light Company has indicated possibilities of much higher steam economy than has heretofore been possible.

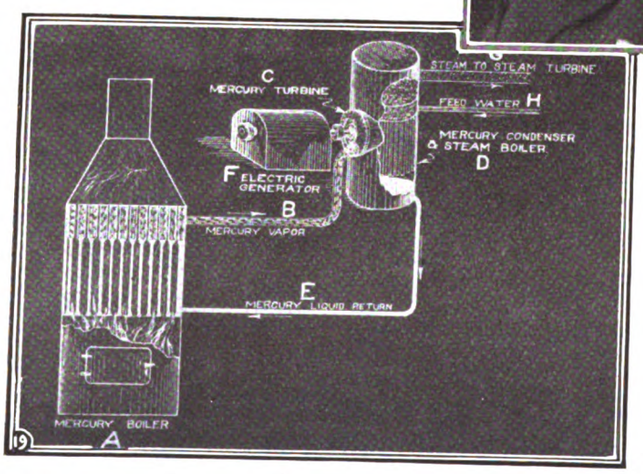


Fig. 19. Diagrammatic sketch of mercury boiler installations. Mercury vapor under pressure is generated in a special boiler and is used to develop power in a specially designed turbine. The exhaust vapor from the turbine is used to generate steam in a second boiler, giving up its heat and condensing to liquid mercury, whence it flows by gravity back to the mercury boiler. The hot flue gases from the mercury boiler are used to superheat steam from the second boiler and to preheat the feed water.

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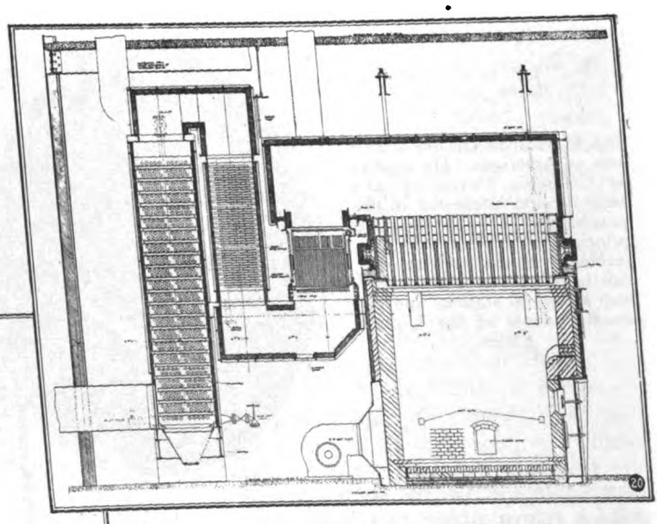


Fig. 20. Sectional view through a mercury boiler plant, showing the provisions made for preheating the mercury, evaporating the mercury, preheating the water and superheating the steam.

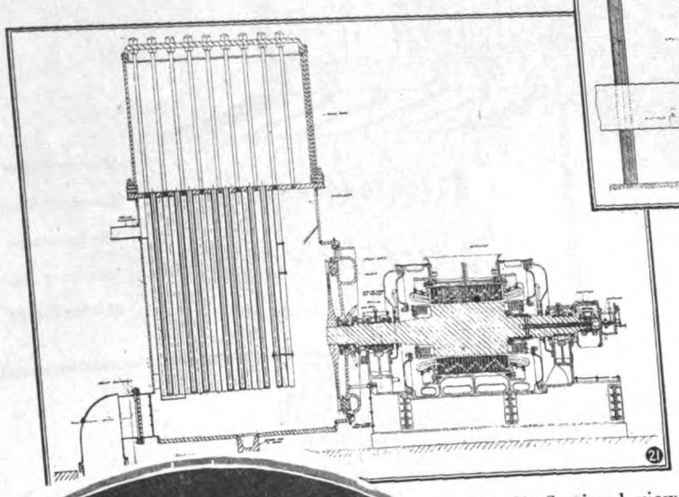


Fig. 21. Sectional view through the mercury vapor condenser (or steam boiler) and through the mercury turbine. The turbine vapor exhaust is condensed to liquid mercury and gives up its heat to evaporate the water in the boiler, or condenser.

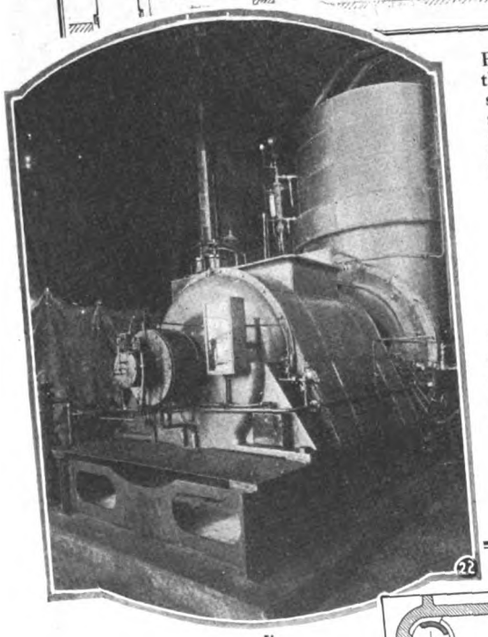


Fig. 22. The mercury boiler installation as it actually looks in real life. While still in the experimental stage, indications are that its commercial success will eventually be assured.

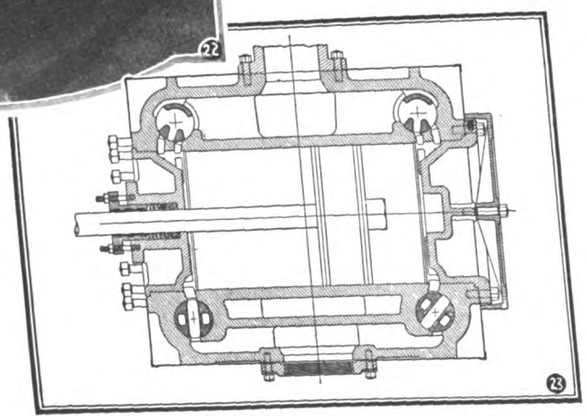


Fig. 23. Section through the cylinder of a modern Corliss engine. Note the four separate valves for controlling the admission and exhaust of steam used in the cylinder.

stage. His later inventions included a throttle valve, a centrifugal governor for controlling the speed, and a steam engine indicator for measuring the work done by the engine.

But Watt's activities, epoch-making as they were, left much to be desired. Inspired by his inventions, various types of valves were developed for automatically controlling the admission of steam to the cylinder.

It remained, however, for George H. Corliss, nearly 100 years later, to automatically govern the speed of the engine by adjusting the cutoff. This he accomplished by establishing a direct connection between the governor and the cutoff mechanism.

Corliss was undoubtedly another outstanding genius. The Corliss valve gear accomplished three fundamental and necessary improvements and foretold the possibilities of high steam economy which we have in our modern engines today. *First,* it reduced cylinder condensation by providing separate valves for inlet and exhaust steam. *Second,* it increased the thermal efficiency because the speed could be governed by adjusting the cutoff and maintaining a high initial steam pressure. *Third,* it made possible separate adjustment of inlet and exhaust valves, thereby increasing the efficiency of the engine under all load conditions.

Perfect as the Corliss engine is today, however, Prof. Johann Stumpf recognized the opportunity for still further improvement and, inspired by his activities of the present day, we have seen the development of what engineers call the "uniflow" steam engine.

It was Prof. Stumpf's idea to elim-

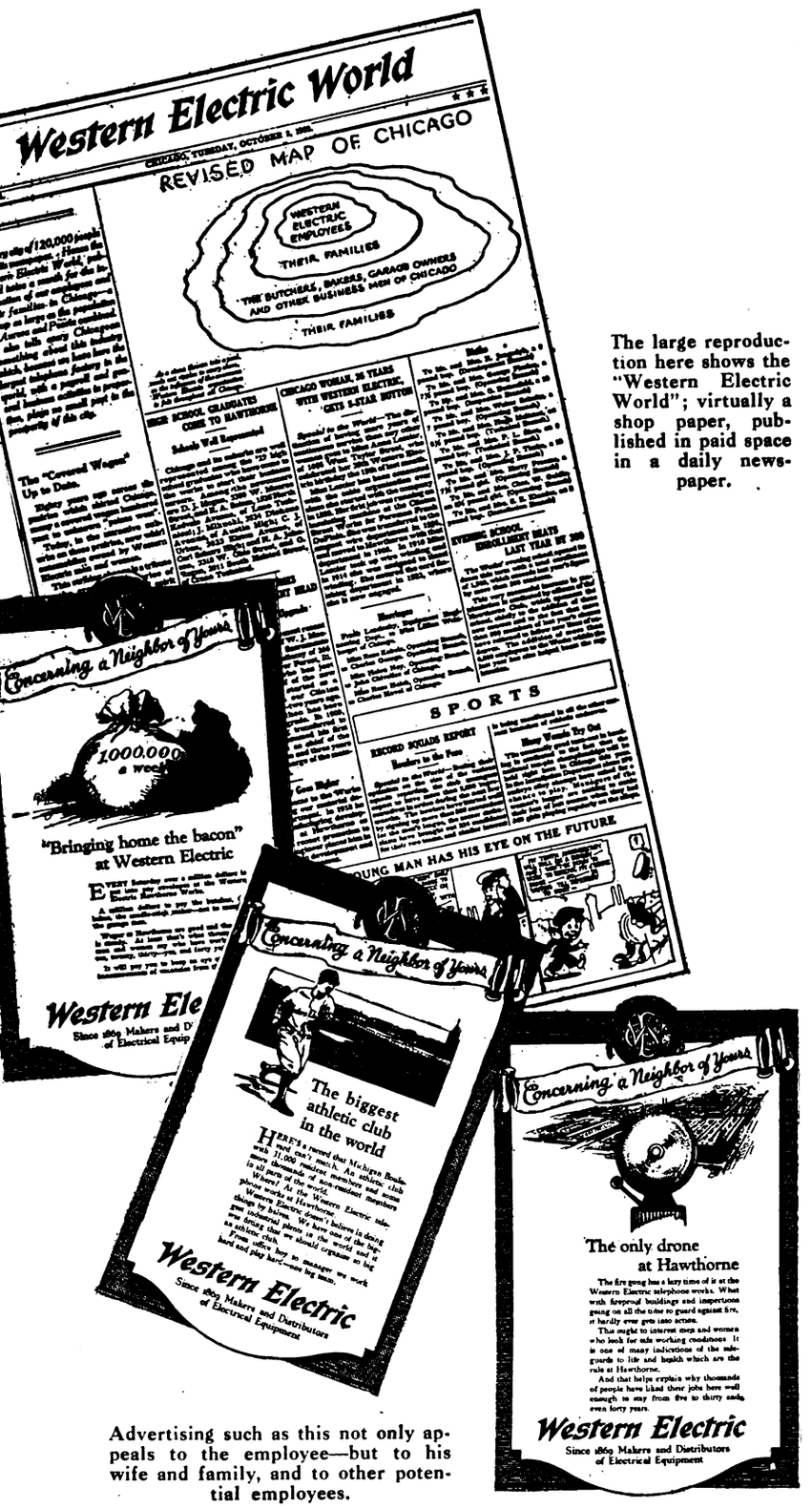
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"Selling" the Company to Prospective Employees

How the Western Electric Company Builds Up Its Family Spirit

By Calvin Lindley



The large reproduction here shows the "Western Electric World"; virtually a shop paper, published in paid space in a daily newspaper.

Advertising such as this not only appeals to the employee—but to his wife and family, and to other potential employees.

WHAT tale does the help-wanted advertisement tell to the worker? It should tell him much. It should awaken his desires, foster his hopes and dispel some of his fears. All this cannot be done in a single chapter. Therefore the publicity aimed to secure a better personnel sometimes becomes, through necessity, a continued story. When the need for desirable help is stated in a series it becomes apparent to the worker that the company advertising has something more in view than putting on a temporary force.

One of the most interesting newspaper advertising campaigns conducted, in which the recruiting of desirable employees was an object, was that of the Western Electric Company of Chicago. Its big appeal lay in the fact that it did not resemble a distress signal. Rather it featured the idea of permanency and that the company had a steady program of manufacturing and growth.

Another thing it was not so plainly labeled as a help-wanted campaign that it could be distinguished as such. In fact it was not that alone. It was good-will publicity that impressed the community with the bigness of the concern and also told the housewives as well how they could profit by using the appliances the company sold.

"Concerning a Neighbor of Yours" was the keynote of the campaign and aptly enough, was used as a permanent heading for the different advertisements.

Consider an early piece of copy used. It showed a picture of a paymaster and a quantity of envelopes with the caption "The 'ghost' a popular figure at the Western Electric Hawthorne Works." The display line of the Advertisement was:

HOW YOUR NEIGHBOR'S PAY-DAY HELPS CHICAGO

Twenty-eight thousand people draw pay at the Western Electric Hawthorne Works. In a week that adds up to over a million dollars.

What do they do with it? Ask the stores. Ask the theaters. Ask the real estate men. Ask the banks. While

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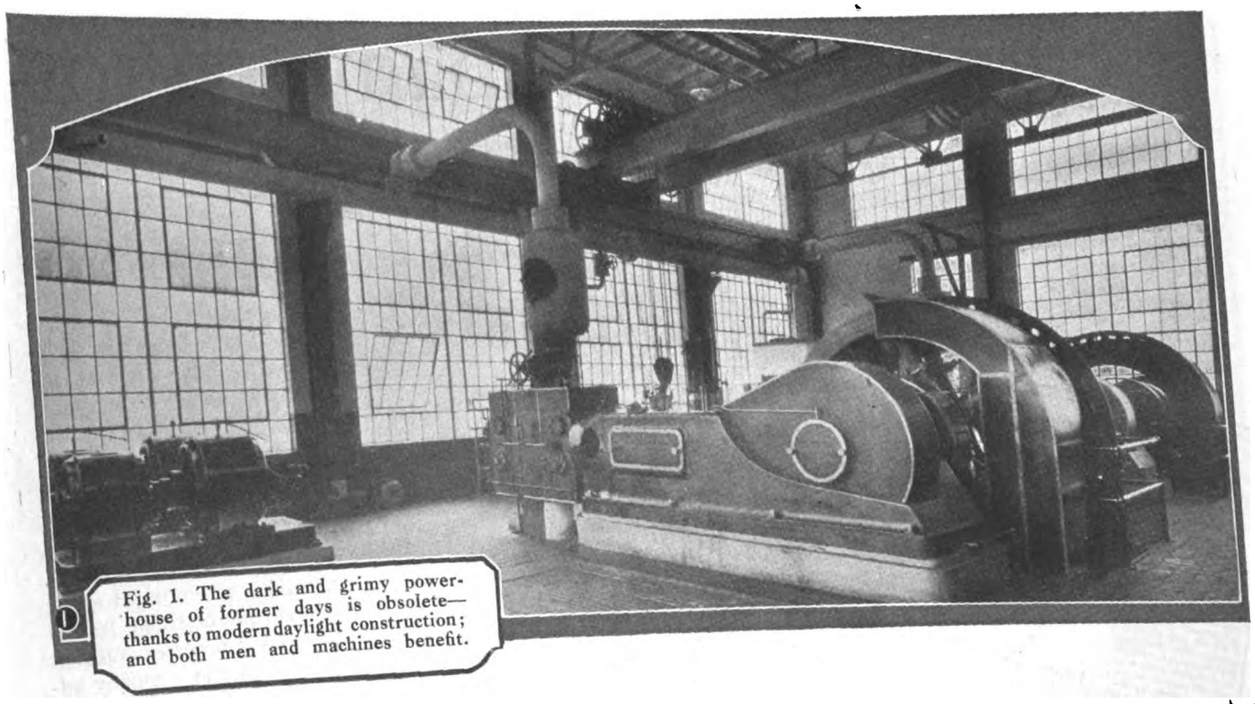


Fig. 1. The dark and grimy power-house of former days is obsolete—thanks to modern daylight construction; and both men and machines benefit.

Putting the Sun on the Payroll

How Modern Construction Provides Maximum Daylight

By Walter F. Ballinger

OF all of Nature's generous gifts to mankind perhaps the most variable in quantity and character is daylight. Science has far surpassed Nature in providing us with uniform easily regulated light.

Nevertheless natural light is counted one of the great aids to production in our modern and efficient industrial world, and our factories are reflecting in the increasing size of their windows, our growing appreciation of its desirability.

Within the past decade or two the design of industrial buildings has undergone a marked change not only in construction but also in fenestration. It was formerly the usual custom to use relatively narrow double hung, wood sash windows separated by an equal width of brick wall. Considering only the wall space between bench height and the ceiling, which is the only possible area in which windows can be effectively placed, it was common practise to have less than half of this space in glass.

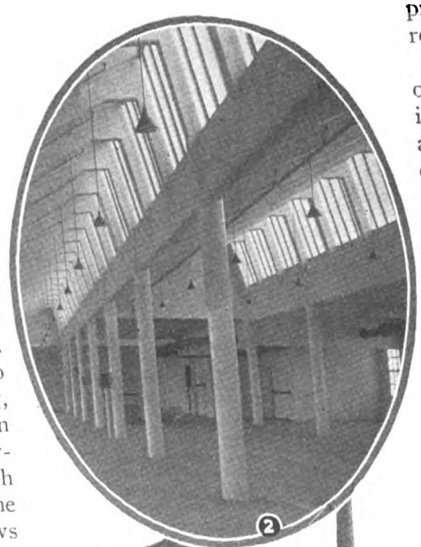


Fig. 2. Above, in the oval, is a section of a sawtooth roofed building, with excellent light-reflecting ceilings and walls.



Fig. 3. A type of construction happily becoming more common; with light and ventilation as primary factors in the design.

Now it is the usual thing to have 75% to 85% of this "possible window area" in glass, and even 100% is obtainable through an ingenious improvement in factory construction recently developed.

Thus the external appearance of our factories has recorded this growing demand for more daylight. So also has the interior changed from dingy room with dark walls and ceilings and many light-obstructing belts, shafting and partitions, to bright clean open light-walled rooms that are as cheerful and pleasant as the older ones were gloomy and depressing.

Changes have also come in windows, glass, wall and ceiling finishes and all the other elements used to bring light into the factory. Before discussing these various details, we should first go back for a moment to natural light itself and consider briefly its principal characteristics.

Natural light varies in intensity from month to month, day to day and

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hour to hour. It is totally lacking during working hours at some seasons, and it is never wholly dependable except in cloudless climates. Direct sunlight is exceedingly intense, and must be shaded from the eyes. Blue sky reflects less light than a cloudy sky. Reflected light from the north sky is the most uniform natural light in quality and quantity. These are pertinent facts to keep in mind.

Consider the average factory lighted by windows in the walls. Investigations by Messrs. Perrot and Vogan have recorded these facts: At the west windows of a building on a cloudy day just before noon they measured a light intensity of 124 foot candles four feet inside the windows. On a sunny day with a bright clear sky (the windows being in shadow) they measured only 20 foot candles in the same position at the same time of day. Thus the dull grey clouds in the first test reflected into the building over six times the light reflected by the clear blue sky of a sunny day.

At the same time they found these conditions at the east windows: On the cloudy day they measured 120 foot candles (6 feet from the glass) while on the sunny day the intensity was 428 foot candles. Thus on a cloudy day the east and west windows obtained practically the same amount of light, while on the sunny day the light varied in intensity from 20 foot candles on the shadow side to 428 foot candles on the sunny side. One side of the building was deficient in light (relatively speaking) while the other side received too much light.

Another fact was developed by these investigators. They measured the intensities of illumination at regular intervals across buildings of various widths. Plotting their readings on a chart produced a curve shaped much like a broad based letter "U," the vertical sides of the "U" representing the higher intensities found near the windows and the base of the curve representing the much lower intensities occuring in the center part of the room. In the center third of a 98 foot building they found an intensity of 2 foot candles on the bright sunny day and only 65/100 foot candles on the dull cloudy day. Hence, in spite of the unevenness of light at the windows, the bright sunlight on one side tripled the amount of light reaching the center.

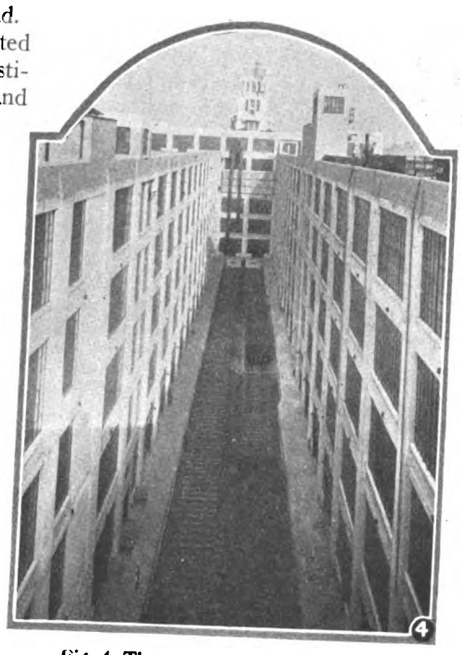


Fig. 4. The open space for light and air here is not wasted; being utilized for the railroad siding.

These three experiments and their results reveal the essential problems in getting daylight into the factory building. Briefly stated, the high intensity of light at the windows must be carried into the center with as little loss as possible and yet the glare of direct sunlight must be subdued.

This paradoxical situation is successfully met in several ways; by increasing the ratio of window area to floor area, by using sawtooth construction wherever possible, by using improved types of glass, and by surfacing the walls and ceilings with paints or other finishes of high reflecting power.

When a new structure is being planned, the well informed designer can secure the maximum amount of light by adopting as many of these tactics as are appropriate under the conditions of the problem.

To increase the ratio of window area to floor area the designer has several alternatives. The most obvious expedient is to keep the buildings relatively narrow while making the windows as large as possible. If other factors such as the shape of the plot or the requirements of the processes accommodated within the building permit a width of not over 60 to 70 feet, a satisfactory intensity of

Fig. 5. It would take but little imagination to make this building seem an ancient castle; but no castle ever had such provision for light and fresh air.



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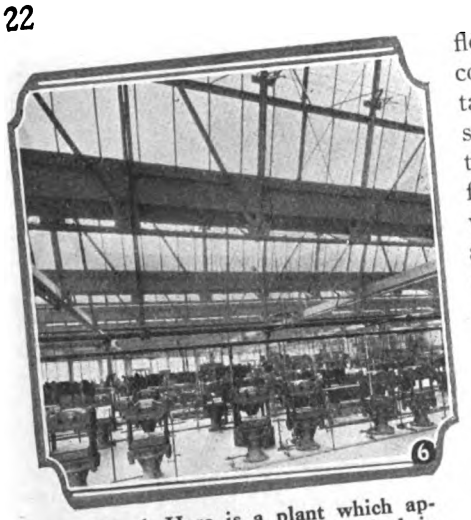


Fig. 6. Here is a plant which approaches very nearly the ideal in natural lighting; literally a case of "working in broad daylight."

illumination generally will be obtained. If a wider building is essential, and light courts or wells are not acceptable, then the ceiling heights may be increased in order to get more glass. This increases the cost of the building as well as the cost of heating and air conditioning.

The other alternative is to eliminate all interruptions to the windows, making them practically continuous from corner to corner. Recently this was actually accomplished in a flat-slab concrete factory building designed by the writer. A spinning mill 121 feet wide was constructed with normal ceiling heights and continuous glass sash, there being no structural piers in the walls, (except for pylons added for architectural effect) from one end of the building to the other. Satisfactory light was procured at the center, 60 feet from the windows.

This improved type of construction permits practically 100% of the available wall area to be of glass. This result is accomplished by carrying the floors beyond the last row of interior columns as a cantilever. The low curtain wall and the glass sash for each story are supported on the edge of the projecting floor slab. Thus the floors support the walls, instead of the walls supporting the floors. There is ample aisle space between the wall and the first row of columns. Since the columns are round and are five feet or so from the windows they cast less shadow and interrupt much less light than wall piers. It is interesting to note that this type of construction is materially less expensive than the concrete building of equal quality.

When overhead lighting is possible, as in one story buildings and in the top floor of multi-story structures, the opportunities for improving the interior lighting are greatly enlarged. There are three important ways of obtaining overhead light through the roof: by using ordinary skylights, monitors, or sawtooth skylights.

The first two, ordinary skylights and monitors, possess the same difficulties presented by windows in south, east, and west walls, namely that they admit the direct rays of the sun which often are too bright and must be subdued. When direct sunlight enters



Fig. 7. An appropriate title for this illustration would be "acres of daylight." In such a structure, dark corners are unknown.



Fig. 8. Here the monitor supplements the high windows, giving better light to the far side of the building, and a more even light throughout.

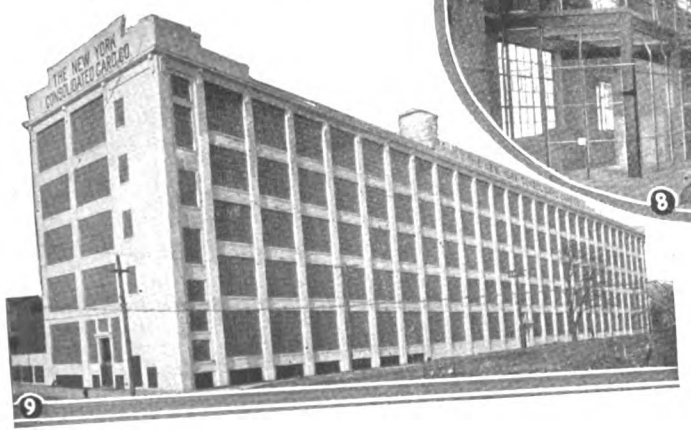


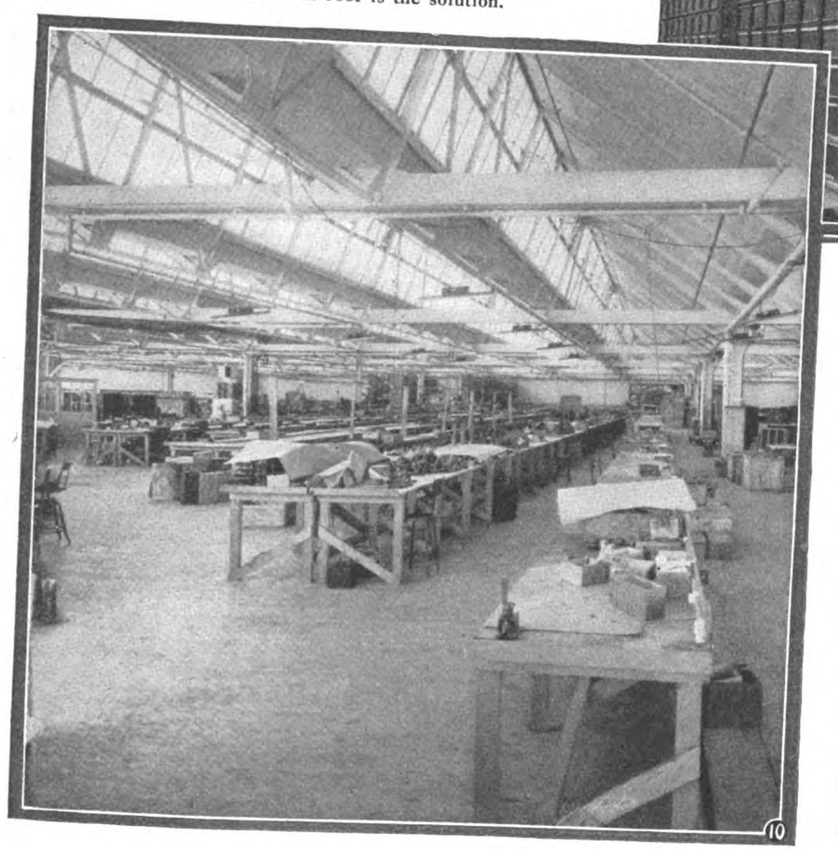
Fig. 9. High ceilings, with windows extending from bench height to ceiling, afford perhaps the commonest method of providing plenty of natural light.

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Fig. 11. The well-known Victor Talking machine plant at Camden, N. J., is an excellent example of handsome architecture combined with modern ideas of good natural lighting.



Fig. 10. Obviously, in a structure of this width, side windows could not possibly supply adequate daylight. In such cases the sawtooth roof is the solution.



through glass the sun's heat also enters, adding warmth which sometimes is undesirable, especially in summer, and at all seasons in plants that are already overheated by the processes contained within. Nevertheless, these two types of light sources have their uses, for they are inexpensive to construct and may be used for local lighting and for any situation where uniformity is not important.

For ideal natural lighting sawtooth skylights are used. They are orientated to face the north, and the slope of the glass is so arranged that direct sunlight cannot enter. As we have already indicated, reflected light from the north sky is the most uniform natural light available, hence a room illuminated wholly by skylights or windows facing the north will experience neither the glare nor heat of the sun, nor will there be sharp shadows. As an actual fact sunlight will enter a north window late in the afternoon for a short period in June in this latitude, but this need not be considered.

For fine machine work, for textile weaving and spinning, for assembling and for all processes requiring color matching, or careful inspection, sawtooth roofs are particularly desirable. It is customary to get an area of glass in the sawteeth equal to about 33 per cent. of the floor area. It is interesting to know that greater interior illumination results from using a smaller number of large sawtooth skylights than from a greater number of smaller sawteeth, other things being equal. This also tends to reduce the cost of construction.

Obviously sawtooth roofs permit very wide buildings where one story construction is permissible. A common objection to this construction is the fact that most sawtooth roofs require supporting columns at relatively short intervals. This difficulty may be overcome in some measure by using heavy "I" beams, eliminating one half to two thirds of the usual number of columns. A few years ago the writer developed and patented a system of trusses known as "Super-Span" sawtooth roof construction which eliminates all columns in buildings up to 100 feet in width and over 95% of the columns in larger structures. This construction is now coming into wide-spread use.

Since sawtooth skylights depend wholly upon reflected light it is well to remember that blue sky reflects less light than a cloudy sky. Thus on clear days the actual intensity of illumination may be less than on "dull" days. To overcome this in a large measure it is simply necessary to use a light colored surface on the roof slopes of the adjacent sawteeth. This reflects the direct sunlight into the skylights whereas a black or dark colored roof would absorb the light.

(*Continued on page 78*)

Fig. 12. One of the few cases where sunlight is decidedly taboo—an ice storage plant.



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Keeping the Electrical Power Equipment Fit

By William G. Ziegler

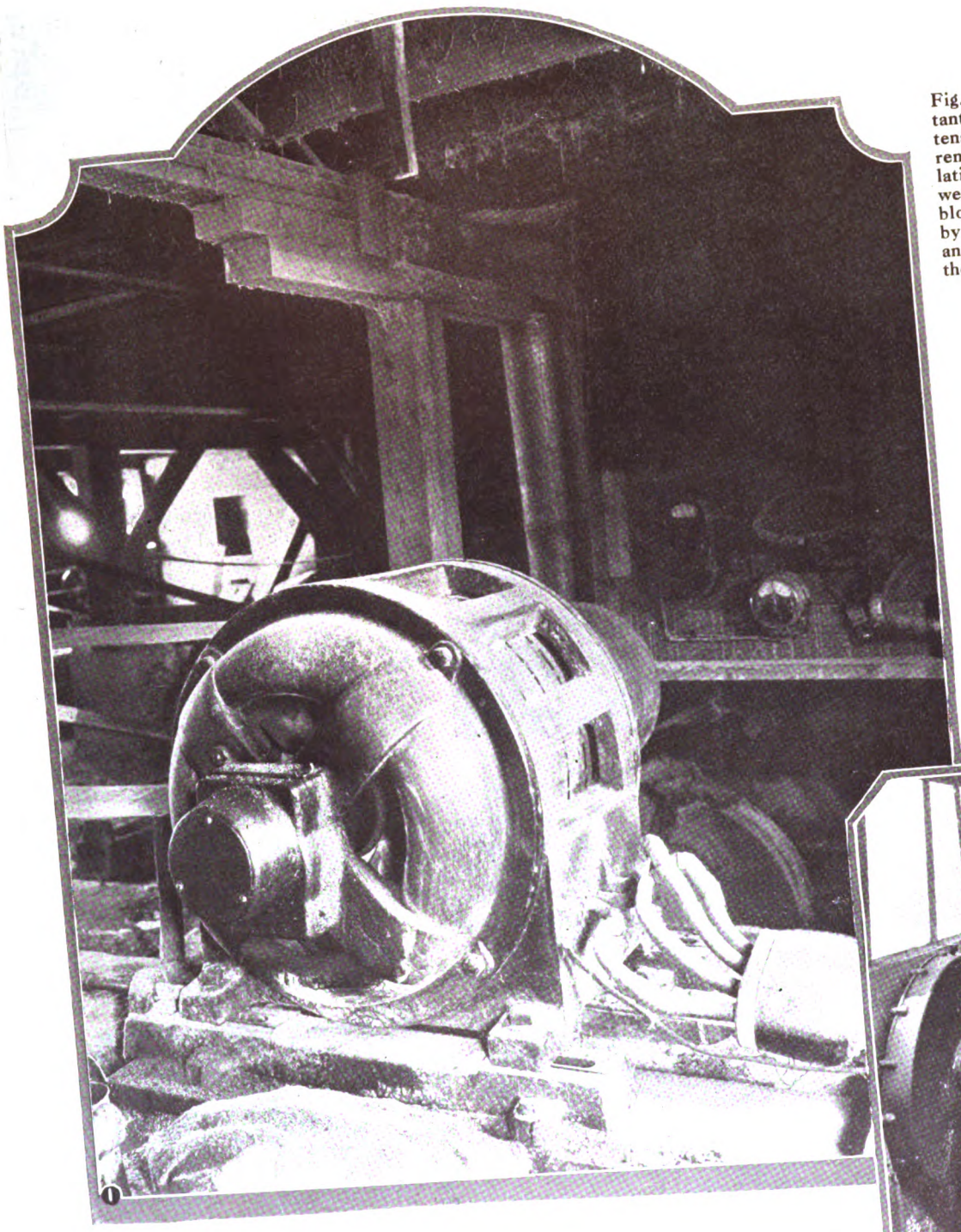


Fig. 1. One of the important items of motor maintenance is the periodic removal of dust accumulations. At least once a week the dust should be blown from the windings by means of a blower or an air gun—or, lacking these, by means of a hand bellows.

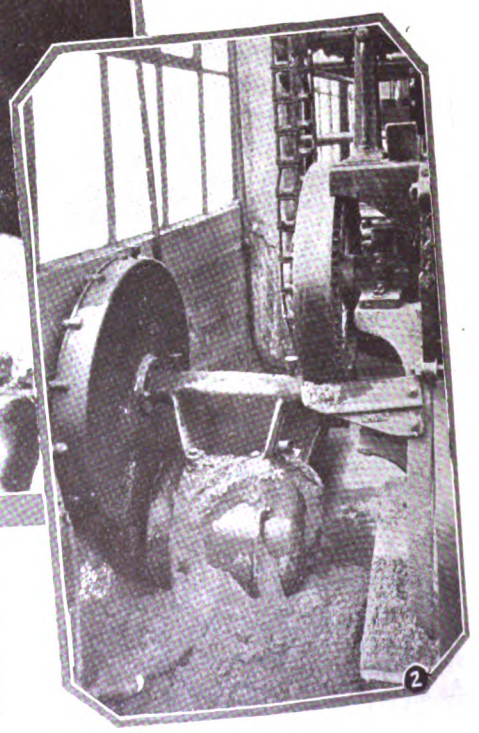


Fig. 2. This motor, operating under exceptionally severe conditions, is equipped with a ventilating system of its own; the pipe for air supply to the housing, leading to a source of dust-free air.

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THE maintenance of the electric power distribution system with its network of wiring, together with motors and other electrical equipment, is one of the most important maintenance jobs in the plant. For production is absolutely dependent on the proper functioning at all times of the motors that drive the various machines and special equipment. And back of the motors is the power distribution system with its wire and fuses and transformers, each one of them playing their part in keeping the motors running. A complete shutdown of a plant due to a short circuit on a main feeder is a rare occurrence, and it is well that it is so, because every idle minute costs hundreds of dollars, directly in pay to the men, and indirectly in overhead and loss of profits while the machines are idle. Most breakdowns are confined to one motor or to one department and are therefore not so costly, but as they are usually due to overloading the cause should be ascertained in each case so that if possible the breakdown will not occur again from the same cause. When not caused by overloads, breakdowns are usually the result of some part of the equipment being out of condition, and as proper inspection and maintenance of the equipment will largely overcome these breakdowns, it is generally considered to be a good investment. Breakdowns due to overloads can be very largely overcome by the constant checking of loads by meters, and this phase of the subject will be treated more fully later in this article. In electrical work the aim should be to make the installation safe, so that workmen cannot possibly get hurt by coming in contact with live wires. Most State and city laws require that electrical work be done in an approved manner, and the various insurance underwriters have drastic regulations, but with all these precautions there are still chances for men to get hurt, and this subject therefore requires constant attention.

If a plant is producing its electric power, it is usual to generate direct current, as variable speeds are easily obtained by the use of a rheostat. If power is purchased it is generally alternating current, except in the centers of some of the older cities, where direct current is still supplied. The power companies usually bring their power to the high tension side of the transformers and put it up to the customer to take care of all wiring from the low tension side of the transformers. With alternating current the starting torque of the motors is not as good as with direct current, and in order to get variable speeds it is necessary to use special motors such as slip ring motors. When power is purchased the rate schedules should be thoroughly gone into so that the plant will get the benefit of the lowest rate possible. It is also necessary to keep a careful check on the use of power to see that it is not wasted. When fuses blow or motors burn out there is usually something wrong and a careful investigation should be made if the same motor continues to give trouble. In one of the earlier articles

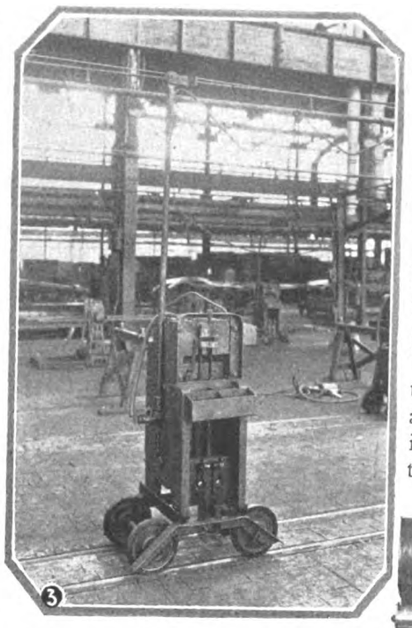


Fig. 3. These electric riveting machines, with overhead trolley current supply, are big time savers in an automobile frame plant.

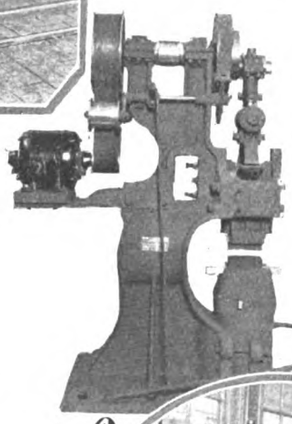


Fig. 4. Individual motor drive, as on this compact hammer, affords many economies over the old time lineshaft; especially where the load is extremely variable.

Fig. 6. The electric arc furnace, with its high temperature and freedom from oxidation, is being used more extensively for metal melting in the production of special tool steels. The heavy current employed requires careful attention to the wiring and control boards.

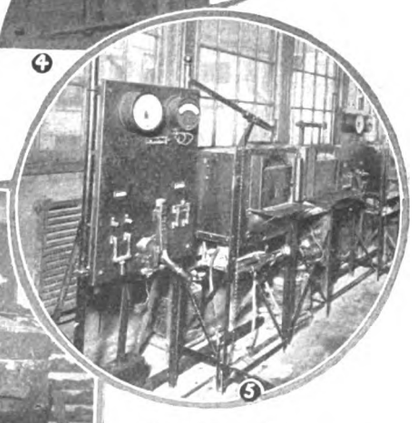
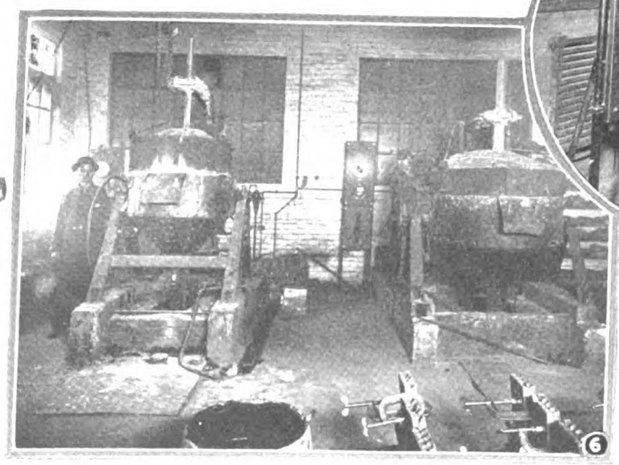
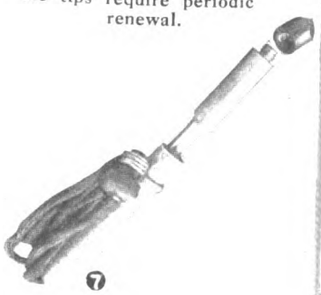


Fig. 5. Even heat control, plus a neutral atmosphere, make the electric furnace especially valuable for heat treating of metals.

Fig. 7. Below—one of many forms of electric soldering iron. These handy tools are made almost fool-proof; though the tips require periodic renewal.





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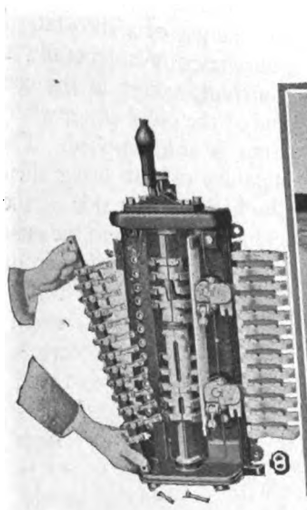


Fig. 8. Drum type controllers are generally used on reversing service. These are usually made easily accessible for cleaning and inspection.

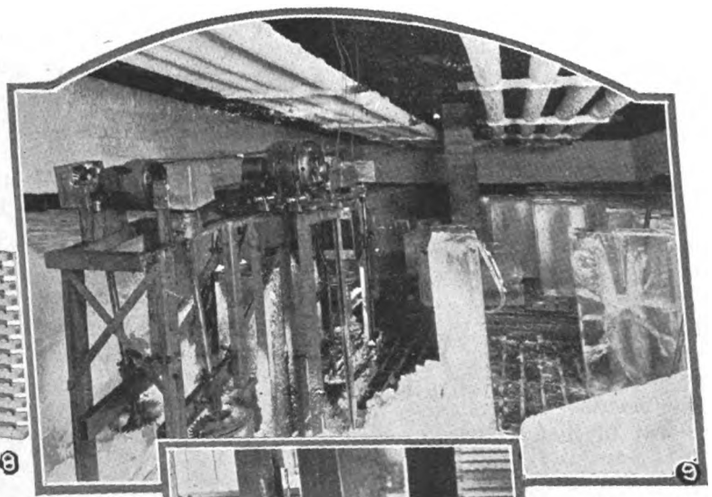


Fig. 9. Motors in extremely cold places are less likely to heat up; but it is well to watch that the lubricant is suitable to low-temperature work.

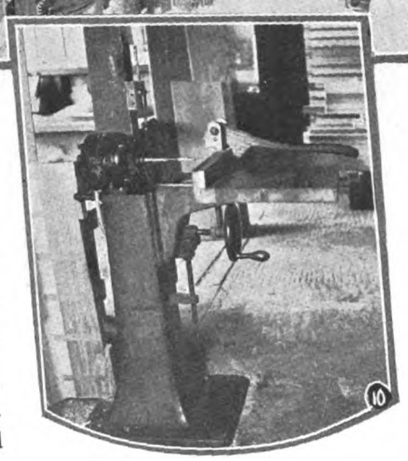


Fig. 10. This motor was converted into a horizontal wood borer by mounting a thrust bearing on its shaft and facing off the bearing housing.

on millwrighting, the point was brought out that tight belts and shafting out of line caused friction and increased the power bill. Tight bearings or bearings without sufficient oil are also power eaters and the use of ball or roller bearings is very often advisable in order to get economical results. Motors which are not loaded are not economical because they cause a low power factor, and it should be the aim of every wide awake engineer to load up motors that are underloaded, to increase the power factor and thereby reduce the power consumed. Coal and power costs are high, and it is easy for wide awake electricians and engineers to make appreciable savings by watching conditions that tend to increase costs.

All high tension wire and equipment should be thoroughly insulated, and guarded at a sufficient distance, so no one can come near it. Transformers are usually oil cooled and the oil temperature is therefore an indication of the temperature of the windings. The present tendency is to install a dial thermometer on each transformer and in many cases to have this thermometer equipped with an electric alarm set to ring a bell when the temperature reaches a certain point.

It may usually be assumed, where power is generated in the plant, that it is direct current, and when power is purchased, that it is alternating current. These current characteristics should be carefully studied and arrangements made for breakdown service from the central station if power is generated in the plant. This breakdown service is expensive and it may be advisable to take care of only a portion of the load, thereby keeping the important units running. When power is purchased, arrangements should be made for breakdown service, either by having a small generator in the plant or by having two sources of supply.

The selection of the correct kind of motor for each job is very important. Direct current motors are preferable for adjustable speed service, for reversing service used on cranes and hoists, and for service requiring frequent starting with high starting torque. In dusty places totally enclosed motors are necessary but as this stops the ventilation of the motor

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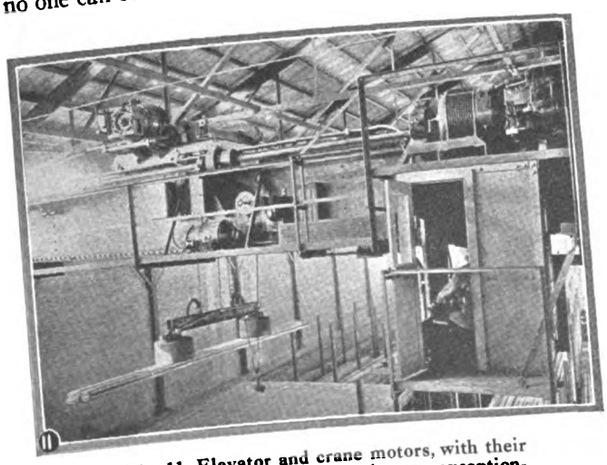


Fig. 11. Elevator and crane motors, with their frequent stops and reversals, are exceptionally hard on starting panels, and these should be under constant inspection.

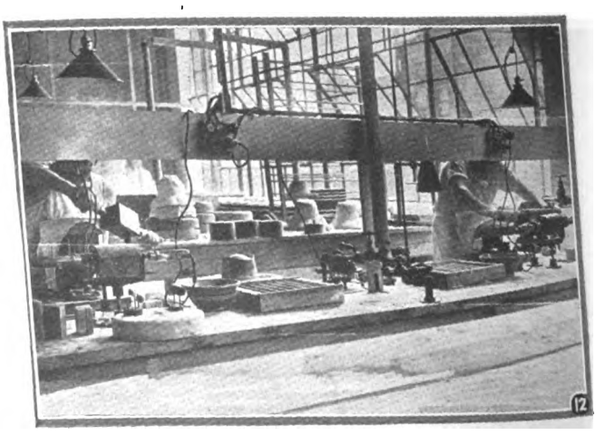


Fig. 12. The growing use of special electric heating devices brings with it a need for better knowledge and intelligent care. The saving due to proper care is often startling.

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American Industry and the Immigrant

By Fred H. Rindge, Jr.



Fig. 1. A Workers' Parade (of which there are so many in European cities nowadays) in Prague.



Fig. 2. Four thousand miles away, in a little Slovak town, the word "New York" conjures up a land of hope.



Fig. 3. These are would-be workers in our industries and on our farms. Our treatment of them has much to do with our future relations with their homeland.





Figs. 4 and 5. American sports are among the most important influences toward a better mutual understanding among workers of different nationalities.

AMERICAN business is tremendously concerned with problems of emigration, immigration and Americanization. In many of our industries twenty to eighty per cent of the employes are aliens. Yet, it is a revelation to some of us that there are nearly 15,000,000 foreign-born in America, and 22,000,000 of foreign parentage—one-third of our entire population!

I have recently visited twenty-three of the countries from which these people come, and am more convinced than ever that they bring with them not only problems but sterling qualities of which we must be more fully cognizant. In the decade previous to the war we averaged 1,000,000 immigrants annually. During the present fiscal year (ending June 30th) we will receive approximately 335,000. This is due to our immigration restriction law, which limits the number from each country to 3 per cent of the number of its foreign-born who were in the United States during the census of 1910. Thus the United Kingdom is allowed the highest quota (77,342); Germany second (67,607); Italy third (42,057) and Poland fourth (31,146). The other quotas are considerably smaller and the majority were quickly filled for the year.

I found the centers of emigration in Europe to be places of intense in-

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The Versatile

How It Serves, in One Form or Another, in

By Matthew

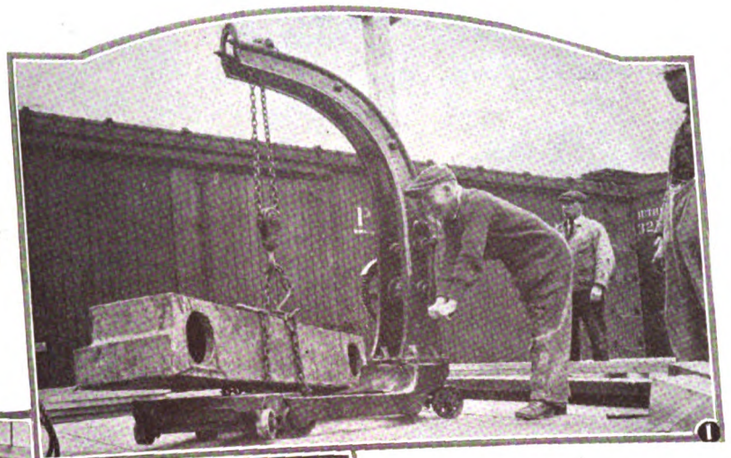


Fig. 1. Small hand-operated cranes reduce handling costs and eliminate danger to workmen from strain.

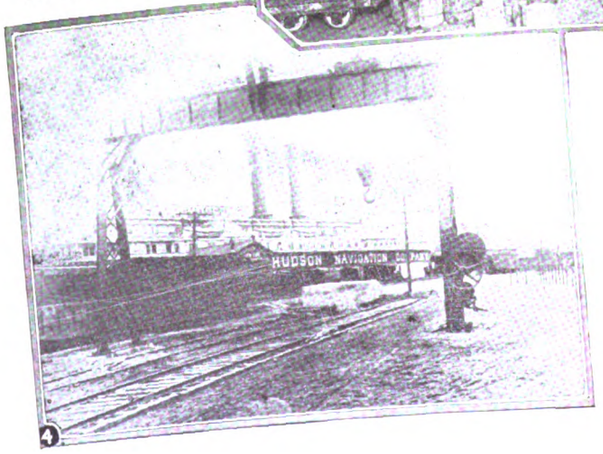


Fig. 2. Cranes can easily be designed to fit the job, and to serve special purposes.

Fig. 3. Hand-power bridge cranes are most efficient where there is only an occasional movement of materials.



Fig. 4. This hand-operated crane has saved both time and money in the unloading and loading of heavy materials from cars.



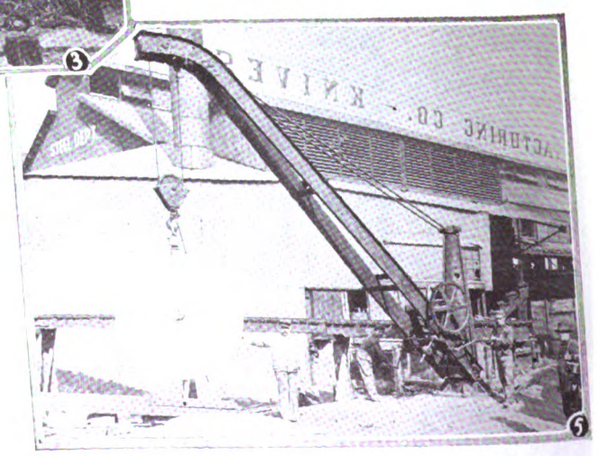


Fig. 5. Hand-power pillar cranes can be used in the yard as well as inside the industrial buildings. Note the sling for handling the load.

THE importance of cranes in the plan of economic plant management has been recognized for years and now, when new buildings are contemplated, the first materials handling equipment that presents itself for consideration is some form of crane. The types of cranes which have been and can be used in and about industrial plants are so numerous that it is impossible to present illustrations of each type in one article. The accompanying photographs, showing successful installations, have been selected with an idea of presenting as diverse a number of operations as possible.

As in the case of other equipment, cranes are subdivided into many classes, depending on the nature of the work to be performed, and some manufacturers have given special names to equipment which they have produced to fit a particular job. Some of the classifications for cranes are as follows:

(a) Skeleton.
(b) Walking jib.
(c) Pillar.
(d) Pillar jib.
(e) Overhead traveling (hand-power or power operated).
(f) Gantry (traveling stationary).
(g) Locomotive (steam, gasoline, electric).
(h) Wharf (portable, semi-portable, roof).
(i) Shipbuilding (hammer head, portable, tower).

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Industrial Crane

Construction, Production, and Transportation

W. Potts

Many other minor classifications under these main types could be enumerated.

The advantages of some of the types mentioned need not be explained to industrial executives, as such cranes have long been employed as materials handling equipment, and the benefits derived from their use, such as reduced handling costs, speedier operation, etc., continue to recommend them for use in shops and yards of industrial plants, in railroad and marine work, and in other places and on operations where heavy materials have to be handled.

Because of the diversity of crane equipment, it is difficult to say that any particular type should be used on any certain operation, as so much depends upon plant structure and operating conditions.

In small plants, on shipping platforms and on operations similar to that shown in Fig. 1, the portable crane known as a "skeleton platform" can be used to advantage. The construction of this crane with a rigid curved one-piece boom and mast mounted on a low skeleton platform, which in turn is supported by small wheels, is especially adapted for use in machine shops, as the low skeleton platform will usually pass under the standards of a lathe and many other types of machines used in finishing

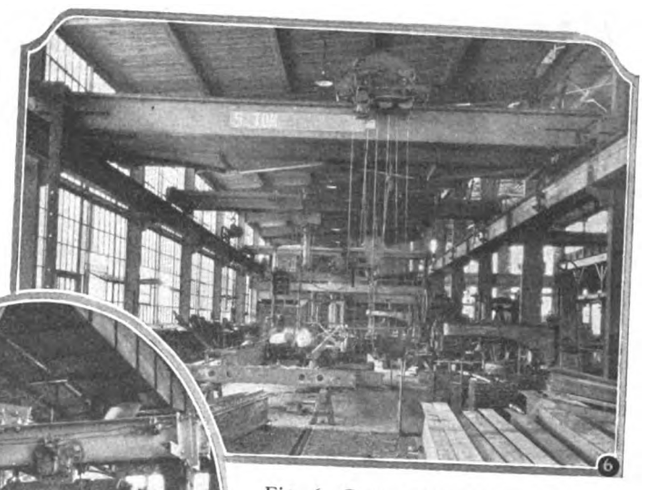


Fig. 6. Cranes are necessities in heavy structural shops. Extended hand control on crane trolley permits the operator to be on the floor near the load.

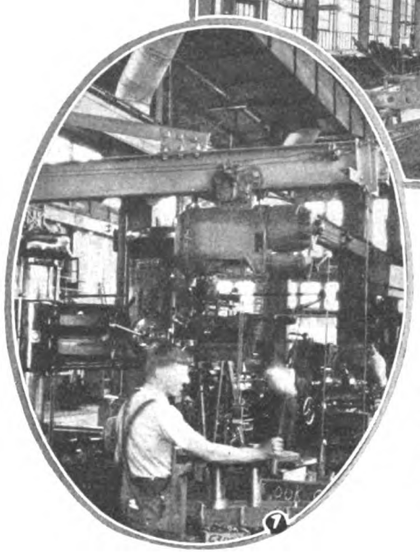


Fig. 7. Electric hoist installed on swinging bracket jib crane eliminates the necessity of operator losing time waiting for a helper to assist him in taking parts or jigs to or from the machine.

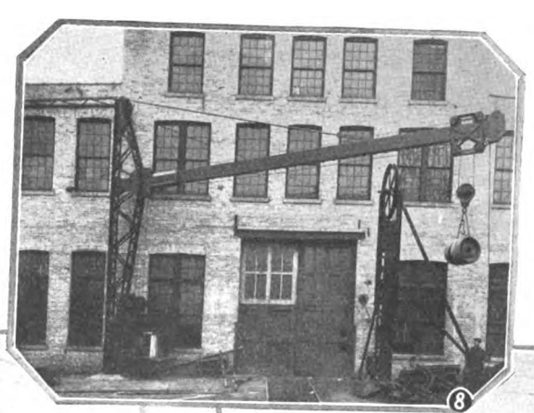


Fig. 8. This jib crane installed in the yard of a large factory has been found very useful for loading and unloading trucks and push cars. It is electrically operated. Note the traveling trolley on boom.

Fig. 9. Derricks are a form of crane. This derrick unloads the logs from the cars, piles them, and loads them again for delivery to the mill.

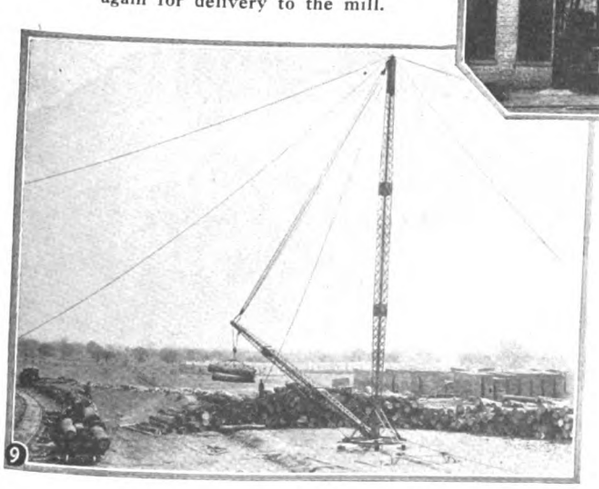
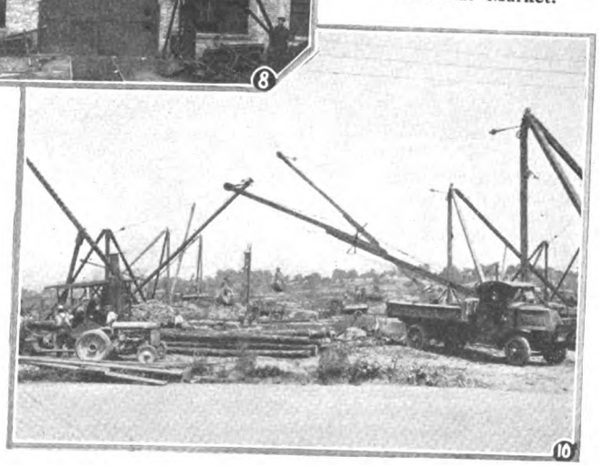


Fig. 10. Wooden derricks equipped with grab buckets are common to large construction projects. This is the equipment used on the foundations of the Bronx Terminal Market.



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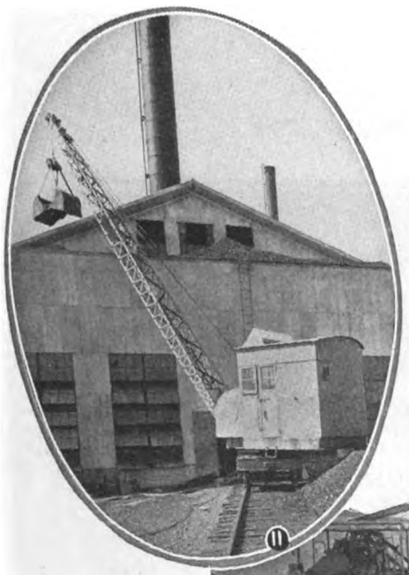


Fig. 11. Locomotive traveling cranes are usually operated by steam. This one handling coal from storage pile to power house is electrically operated.

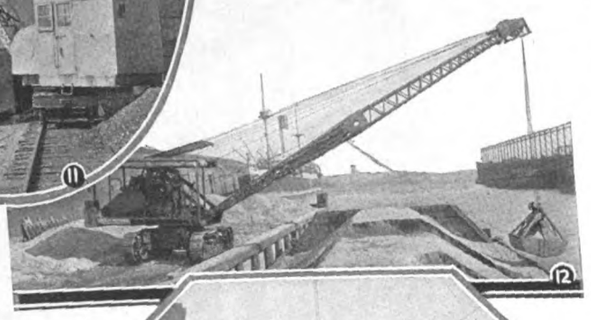


Fig. 12. Gasoline cranes mounted on caterpillar tractors are now becoming quite common. They invariably reduce handling costs and handle bulk materials quicker than shovel gangs on the operation shown.



Fig. 13. The equipment below the crane hook is as important as the crane. A clam-shell bucket is generally required on work of this nature.

machine parts. With this crane it is possible to bring a heavy casting close up to a machine and hold it suspended on a jib hoist, until it has been adjusted to the machine ready for operation. Fig. 1 shows such a crane, and illustrates the method of operation. In this type the boom curves directly over the platform so that the weight of the load will not topple the crane. The hoisting hook is attached to a sheave block carried by the hoisting chain and is suspended from the end of the curved boom. The hoisting chain runs over a series of sheaves on the boom and thence to the hoisting mechanism, generally a gear type winch near the foot of the mast. The power is applied to this geared winch by means of a hand crank and man power.

Occasionally special operations and conditions require special cranes, and the one shown in Fig. 2 illustrates what can be accomplished. This crane has a 2-ton capacity and is operated by hand. The revolving or swinging type of boom permits the serving of a large area. It will be noted that the lifting mechanism consists of a chain hoist and that the boom is counterweighted so as to balance the punch which is suspended from the chain hoist hook. The longitudinal movements of the crane are taken care of by means of the large hand wheels on either side. This type of crane would come under the classification of walking jib cranes.

The most common types of cranes are the overhead traveling and locomotive. These cranes are used indoors or outdoors, in foundries, steel mills, machine shops, power and coal-



Fig. 14. Electric magnets assist the crane in handling materials of this nature.



Fig. 15. Neither the clam-shell bucket nor the electric magnet could be used for handling ties. The device shown has proven a success.

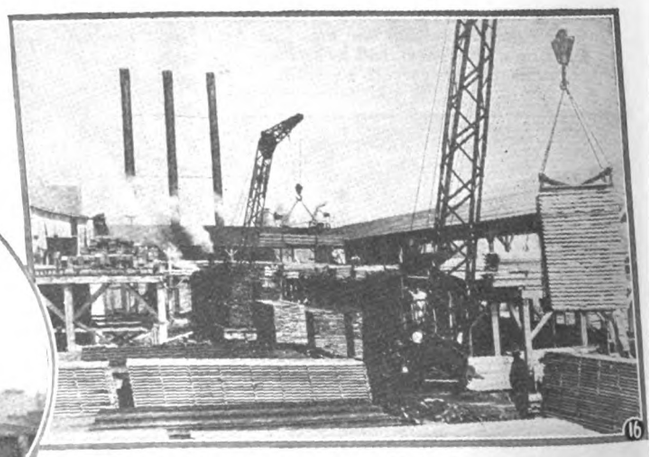


Fig. 16. Cranes can handle flat lumber as well as ties by special attachment. A regular standard lumber handling crane will handle all the way from 100,000 to 300,000 feet per day.

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ing stations, in warehouse or storage yards; in fact on any industrial work where the lifting and moving of heavy materials are required.

The overhead traveling crane is more generally used within the industrial plant because of its adaptability to manufacturing processes. Being installed on an elevated runway it permits the use of the entire area of floor space within its range for storage or manufacturing purposes, and having both transverse and longitudinal motion it will reach any part of a room or space in which it is possible to provide the track. Cranes of this type are constructed and equipped in a great many ways for a wide variety of uses, ranging from the single girder of short span, equipped with a simple chain or air hoist and handling comparatively light weights, to the four or six girder cranes, and the general purpose cranes with box or lattice type girders equipped with crane trolleys and hoists capable of raising 300 to 400 tons or more.

Different types of overhead traveling cranes are shown in illustrations Figs. 3, 6, 18, 19, 20, 22, 23, 24, 26 and 27 and some of the many places where they can be economically operated are presented. Fig. 3 shows a hand-operated two-girder overhead traveling crane being used in connection with the storage of heavy equipment used by erectors and contractors. This same type of crane can be used in manufacturing buildings, power houses, etc., but as far as its use in the storeroom is concerned it is well to mention that it is confined solely to the transportation of heavy equipment over the floor to the shipping

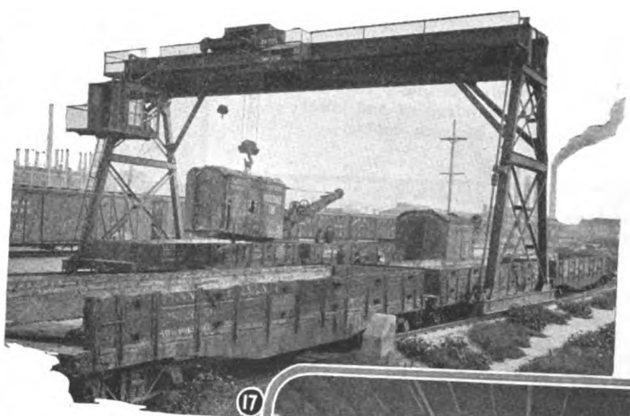


Fig. 17. This electric gantry crane with a span of 59 feet, a 25 ton main hoist and a 5 ton auxiliary hoist, in the freight yard of the Pennsylvania and Detroit R. R. speeds up the loading and unloading of cars.

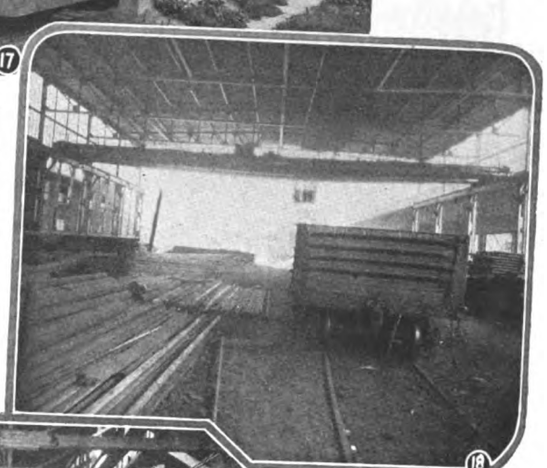


Fig. 18. Cranes can be built for almost any capacity and any span. The one shown has a capacity of 5 tons with a span of 97′ 6″.



Fig. 19. This crane is a typical heavy-duty steel mill design, yet when installed in a low building, the crane only takes 2′ 6″ head-room, and the crane-hook when in its highest position is only 3′ 8″ below the highest point of the crane.

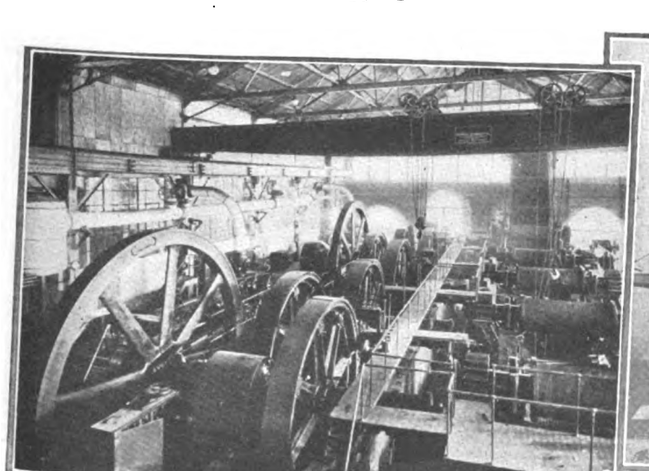


Fig. 20. Where heavy machinery is installed, a traveling crane is a necessity and will save money during installation and on all maintenance and repair jobs where heavy parts have to be removed.

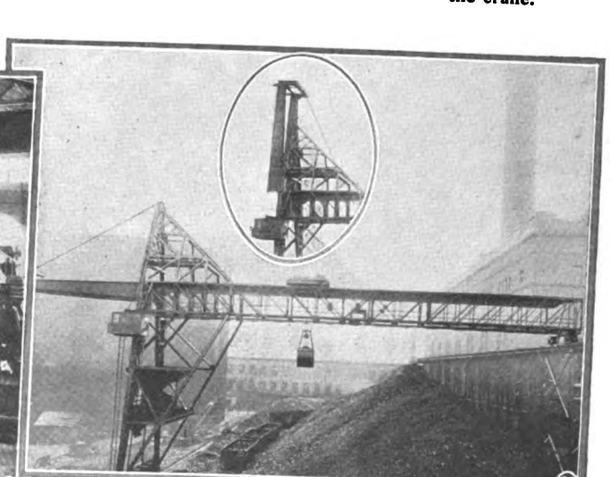


Fig. 21. This gantry crane has a movable cantilever which permits running beyond the gas-holder which otherwise would have limited the longitudinal travel.

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Fig. 22. Foundries use traveling cranes for many materials and handling operations. As the bird's-eye view shows, handling on the floor would be practically impossible.





Fig. 24. Warehouses for long pieces, bar stock, and heavy materials, have found traveling cranes to be one of the best types of materials handling equipment to reduce handling costs.

door for loading onto trucks, etc., and for taking equipment from trucks and placing it in the proper storage space. The use of a crane in this capacity is purely to eliminate the high cost of handling in and out of the storage house. Two men and the crane can move very heavy equipment with very little effort; there is no necessity to use rollers and planks, thus possible accidents are avoided, and the entire floor space can be used for storage purposes.

The importance of cranes in structural shops is clearly shown in Fig. 6 where three different cranes can be seen in a manufacturing bay about 60 feet long. The two cranes in the rear are hand operated and are equipped with electric drills in place of hoist hooks, while the crane in the

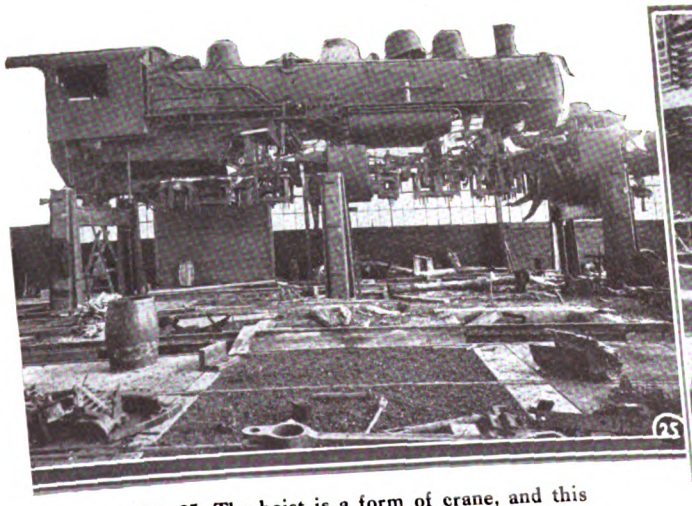


Fig. 25. The hoist is a form of crane, and this Six-Jack locomotive hoist can easily handle a 300 ton compound locomotive for de-wheeling.

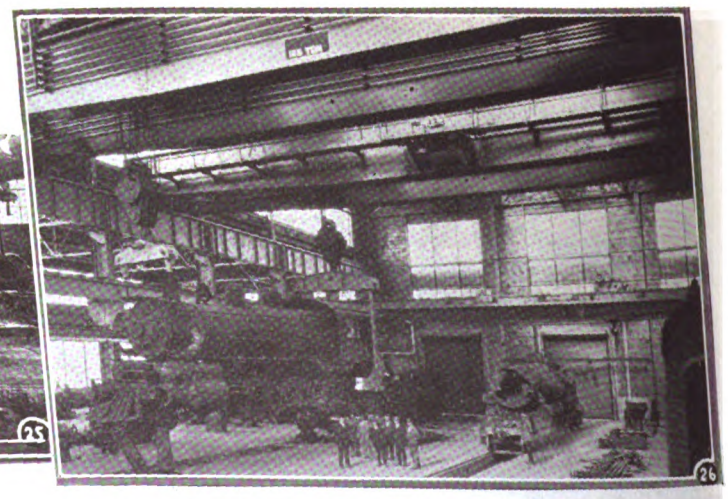


Fig. 26. Heavy loads can best be handled by cranes. These two 125 ton electric traveling cranes have a span of 97′ 5½″ and are used for handling locomotives in the shops of the Chicago, Burlington & Quincy Railway, Denver, Col.

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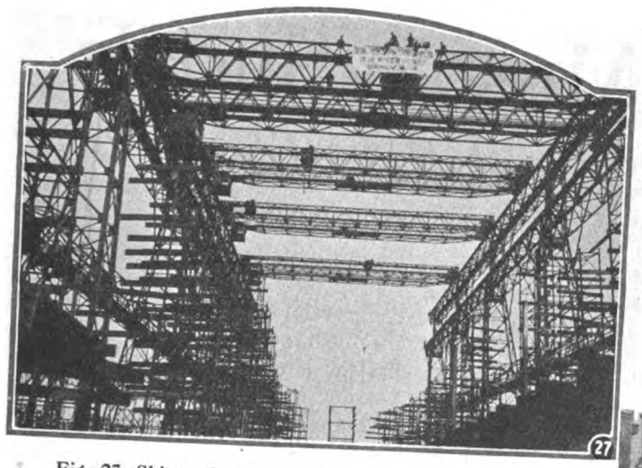


Fig. 27. Shipyards and ships have for many years used cranes for the handling of materials. This shows the cranes over the ways of the Bethlehem Shipbuilding Corporation, Fore River Plant, Quincy, Mass.

foreground is electrically operated. This crane is equipped with a convenient floor control instead of a cab control. When the span or movement of the crane is short, a floor control may be used to advantage. The operator being on the ground near the work, can move the load as desired, and his being adjacent to the load, will naturally reduce the possibilities of accidents. In addition if constant service is not required, and the State laws will permit, the crane can be operated by a workman engaged in the work in progress, thus eliminating the expense of a special crane operator.

A crane similar in design to that shown in Fig. 3, but of longer span

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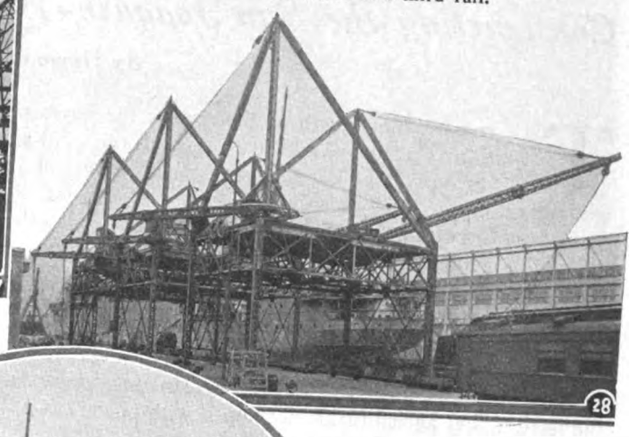


Fig. 28. This installation of three large gantry cranes is equipped with derricks on alternate corners. These cranes are electrically operated and they are self-propelling, obtaining the power by means of a shoe and third rail.



Fig. 29. The Isthmian Steamship Line's ship "Steel Vendor" is especially equipped with two unloading cranes for the handling of steel. These cranes eliminate a great many masts and booms which otherwise would be required.



Fig. 30. This revolving double cantilever crane serves a large storage area for handling clinker at the plant of the Riverside Portland Cement Company, Riverside, Cal.

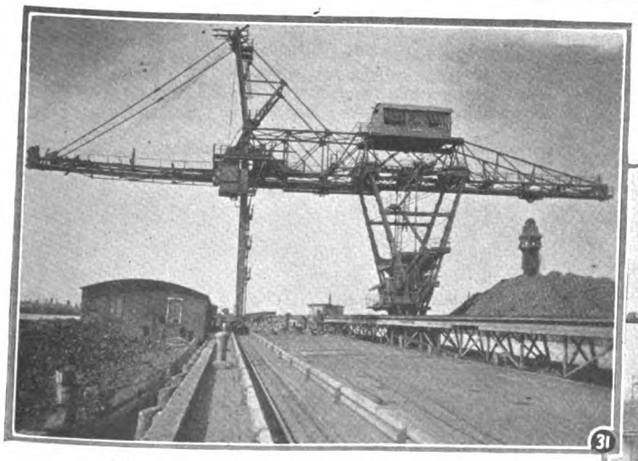


Fig. 31. The structural details of cranes can be designed to meet practically any condition. This electric rope system bridge tramway is arranged to operate a 4 ton ore or coal grab bucket, and in addition is equipped with a hopper and weighing device.

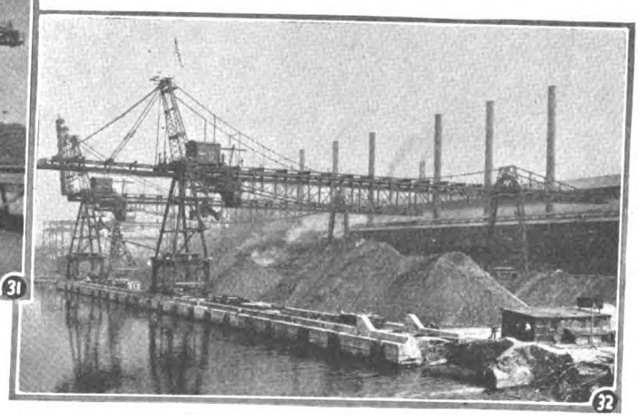


Fig. 32. Steel mills and large users of bulk materials, received at the plant by cars or ships, find the bridge tramway with large capacity buckets, an economic factor in their handling costs.

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Bigger Than Muscle Shoals

Constructing the San Joaquin-Big Creek Hydro-Electric Project

By Herman J. Hanna

THE remarkable growth of the State of California is a matter of universal knowledge; and the reason generally attributed is that of more comfortable living conditions, together with the general tendency of all peoples westward. The increase in population indicates there must be a more substantial basis than that of an equable, mild climate. This is true, for the varied industries, the agricultural development, the extractive industries, foreign trade, and the caring for the needs of those living here, have made the growth of this State equal in practically all other respects that of its population. The superior climatic conditions have enabled the people to develop to the utmost the resources found here.

However, industry and population can only grow as they are supplied with power. California has not been blessed with deposits of coal, and the continuance of its supply of oil for commercial uses is uncertain. But in the "White Coal" on its mountains lies the latent energy that will make possible a further increase in population in keeping with that enjoyed in the past.

This is being accomplished in Southern and Central California by the San Joaquin-Big Creek hydro-electric project of the Southern California Edison Company. When completed, in 1935, there will be made available for power requirements of this section, 1,407,000 horsepower of electrical energy. This will meet all power demands, keeping steadily ahead of the needs at the peak load period.

In the difficulties encountered and overcome, in the new departures in constructive engineering science, in display of ingenuity to meet unforeseen conditions, and in creative resourcefulness, this project maintains the same proportions towards others as in actual cash outlay. And in its benefits to humanity, in the direct influence in the lives of millions, this project will play just as vital a part as any other. For when the contemplated work is completed, the Edison generating system will have a load and diversity factor equal to supply all the electrical demands of a population of five and a half million people.

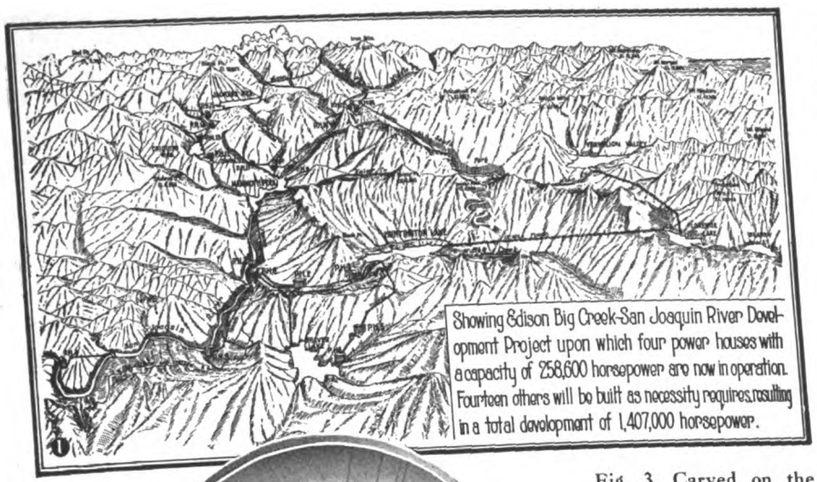
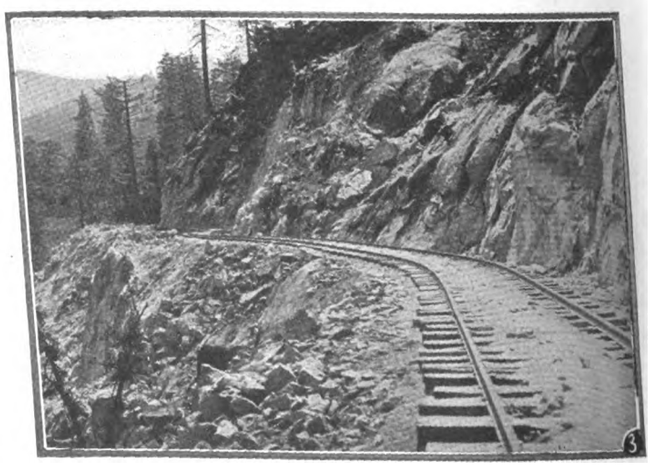




Fig. 2. One of the many tent cities that dot the mountains along the path of construction. These camps, which consist of dining room, club room, baths and sleeping cabins, are built conveniently near section of work where men are employed, and are moved as work progresses.

Fig. 3. Carved on the face of the sheer wall of granite, this railroad is a marvel to engineers and sightseers. The first materials were carried into the mountains with automobile trucks, and as the road was built, an engine was used from El Prado to the end of finished track.



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The Big Creek Development Project is located seventy miles northeast of Fresno in the Big Creek-San Joaquin watershed, in what is known as the High Sierra Mountains. It is a progressive plan of development comprised of a series of reservoirs, dams, tunnels and powerhouses designed to impound and conserve the waters of the San Joaquin and its tributaries, after which they pass undiminished and in more seasonal flow to the ultimate purposes of irrigation, in the San Joaquin Valley. This is conservation in the highest degree.

The water, collected in Florence Lake and led thence to Huntington Lake by means of a tunnel, and also collected from other mountain sources, is ready to pass through the powerhouses which extract its energy. After having been collected in Huntington Lake it may journey successively through Powerhouses Nos. 1, 2, 8, 3 and 4; or it may pass through Powerhouses Nos. 5 and 6, and run into Shaver Lake Reservoir, where it can be stored for another period and sent through Powerhouses Nos. 2A, 8, 3 and 4. In either case, the water falls a vertical distance of over one mile. The electricity so generated is then to be transmitted to load centers in the San Joaquin Valley and in Southern California, the latter a distance of 270 miles.

The history of the project, and outline of work to be carried out in the future, is highly interesting and instructive. In 1883 John S. Eastwood, a noted engineer, made the first trip into the Big Creek-San Joaquin region and conceived the idea of its hydro-electric power potentiality.



Fig. 4. Fifteen feet of snow on Kaiser Pass, at an elevation of 8,200 feet, between Huntington and Florence Lakes in the High Sierra.

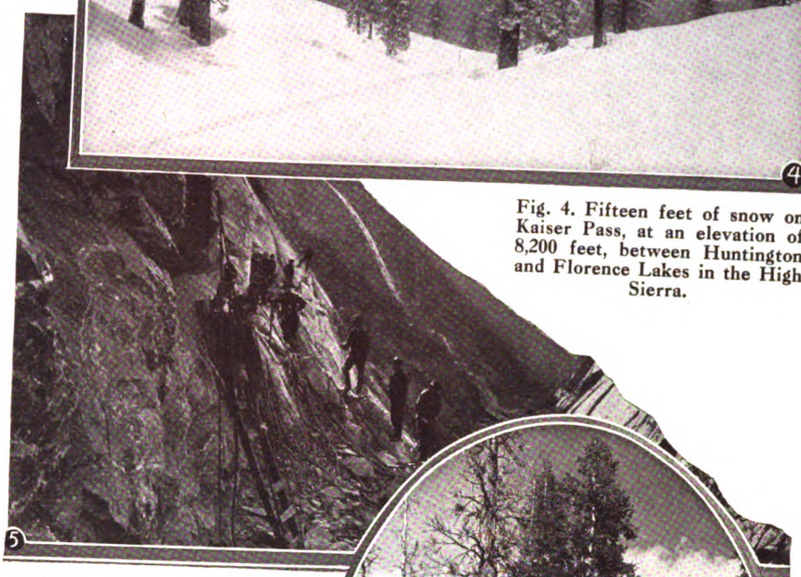


Fig. 5. In preparation for the Edison project, the first step was the building of the automobile road to Cascada, every mile of which was blasted from the granite wall of the San Joaquin Canyon.



Fig. 6. Automobile road between Cascada and Huntington Lake.



Fig. 7. Preparing to drill another heading, in the process of driving one of the tunnels.

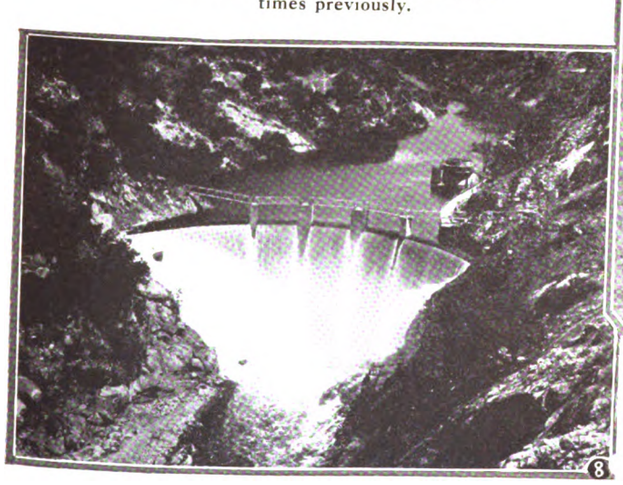


Fig. 8. Diversion dam in San Joaquin Canyon, turning water through tunnel in mountains for use in fourth power house having been used three times previously.

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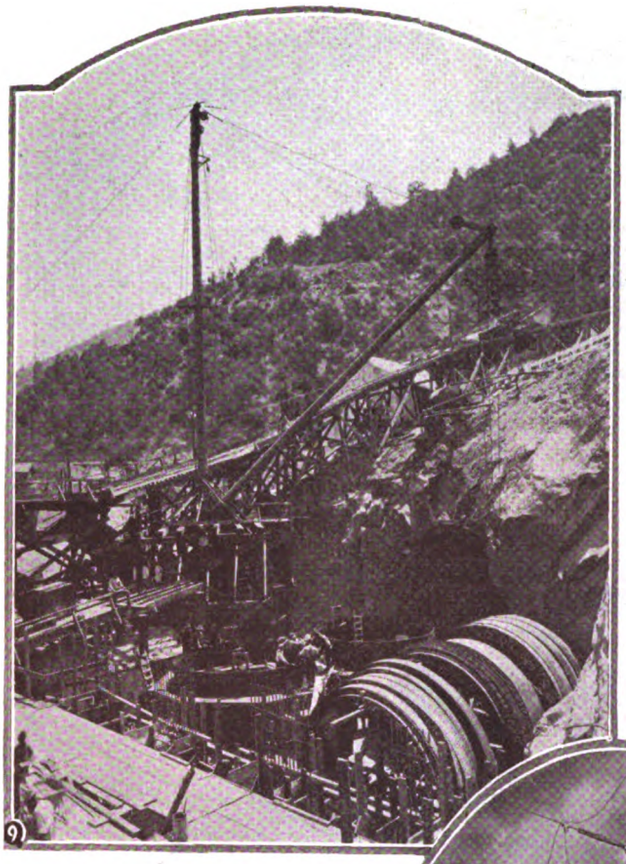


Fig. 9. Assembling 18-foot penstock at terminal of six mile tunnel conveying water to Big Creek Plant No. 3. Just below this point is a manifold where the water is divided for three separate penstocks, each supplying one water wheel.

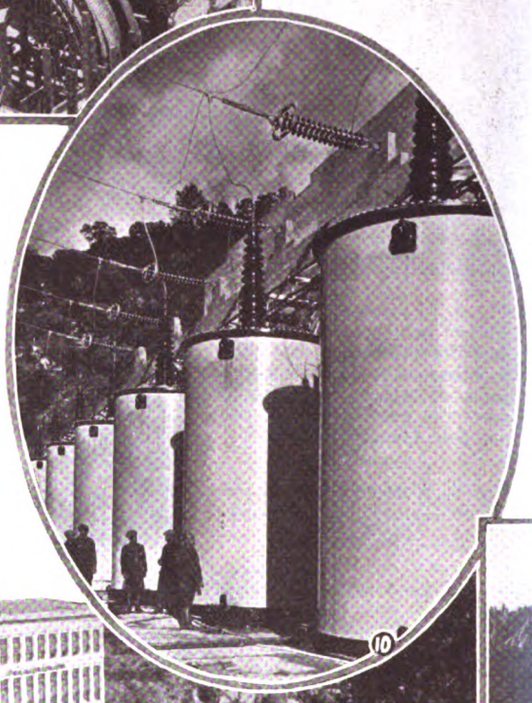


Fig. 10. 220,000-volt transformers at one of the power houses. Each transformer has a capacity of 18,500 kva.

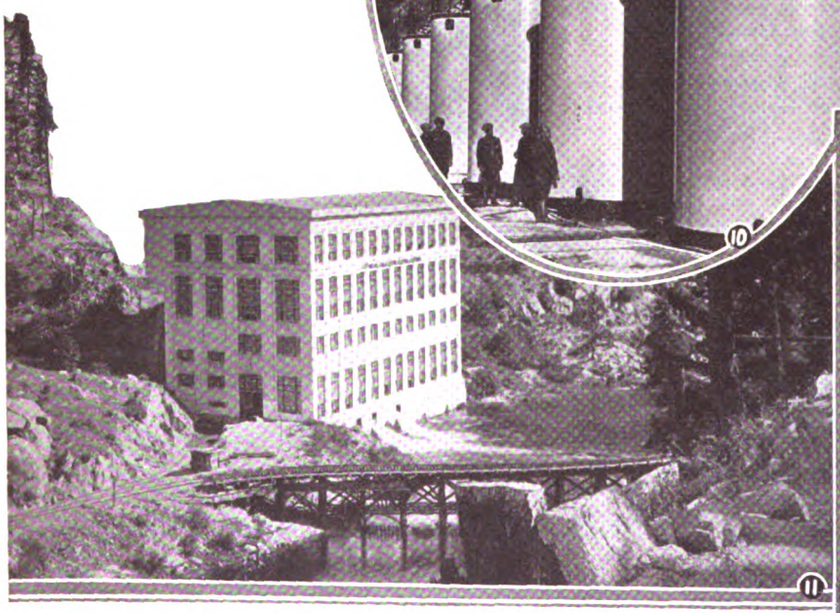


Fig. 11. Edison plant No. 1, contributing 66,000 horsepower to the Edison system.



Fig. 12. 220,000-volt transmission line connecting the generating plants at Big Creek with the distribution centers near Los Angeles—275 miles away.





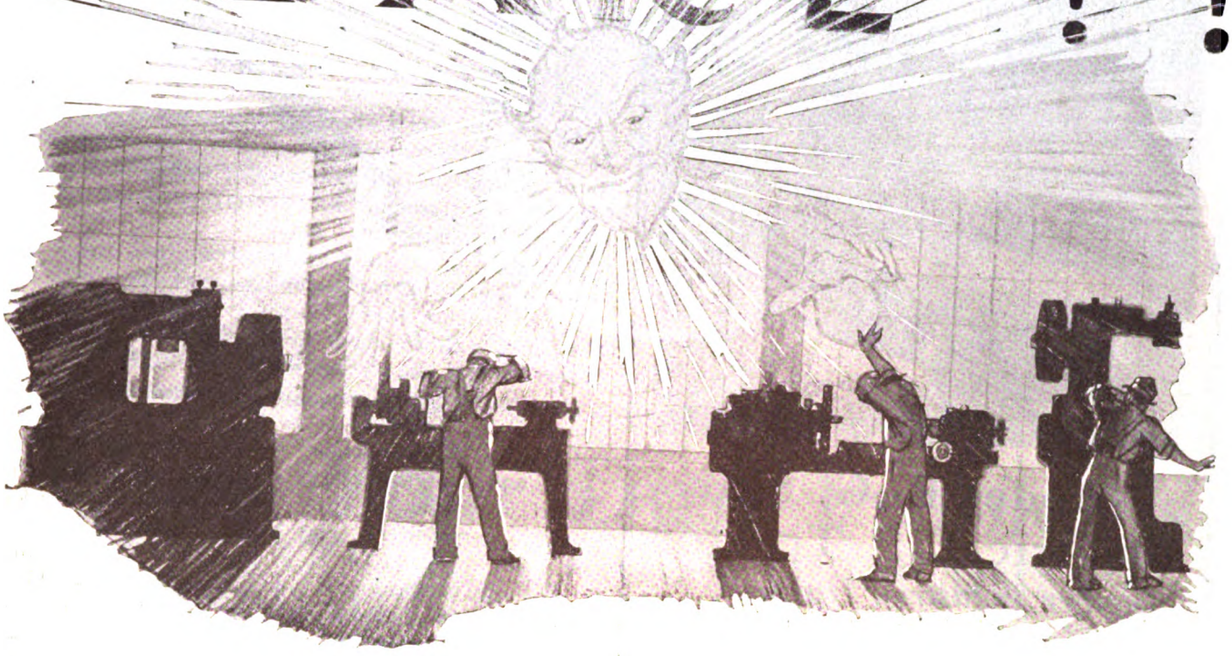






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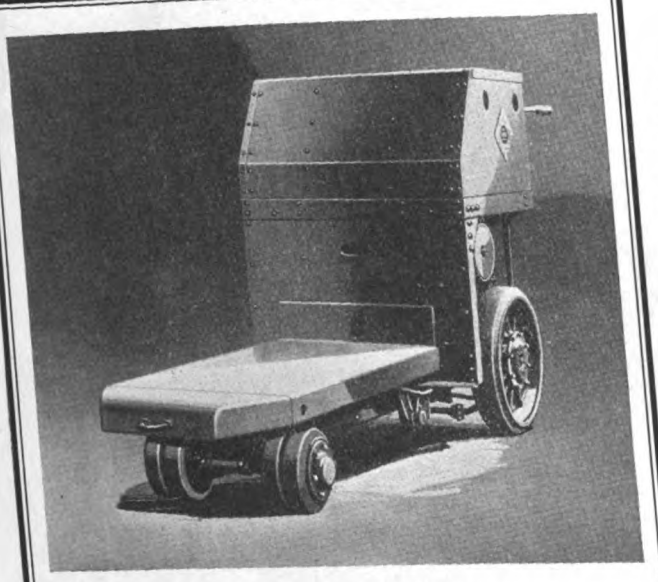
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The ELWELL-PARKER ELECTRIC COMPANY
Cleveland Ohio

Bigger Than Muscle Shoals

(*Continued from page* 36)

of the Lake to 88,000 acre feet. Powerhouse No. 1 was started in 1912, and completed to an initial capacity of 44,000 horsepower in 1913; and by the addition of a third unit in 1923, increased to a capacity of 66,000 horsepower.

Powerhouse No. 2, six miles down the canyon of Big Creek from Powerhouse No. 1, was also completed at this time with an initial capacity of 44,000 horsepower, which was increased in 1921 to 66,000 horsepower by the addition of a third unit.

The third powerhouse in the stream, two and a half miles below No. 2, at the confluence of Big Creek and the San Joaquin River, known as Powerhouse No. 8, was built with an initial installation of 30,000 horsepower and put into service in October, 1922.

The fourth powerhouse (No. 3), the "Electric Giant of the West," five miles below No. 8 on the main stream of the San Joaquin River, was commenced December, 1922, and came into service on October 16, 1923. Its initial installation of three units will generate about 105,000 horsepower. This brings the actual development down to date.

With the completion of No. 3, deep and careful study is being made of the working out of the big problems arising in the successive steps of development. The great and dominating factor in the determination of the problem is to supply at the cheapest possible cost the enormous volume of power which the growth of the ten counties of Southern and Central California require. Next, is to work without interruption the great construction army of the Edison Company, thus minimizing the cost of labor turnover and securing the highest degree of human efficiency.

Some idea of the magnitude of the undertaking may be obtained by a comparison with the world's greatest construction jobs. There being no data available whereby one could ascertain the various items of expense, as labor, materials, transportation, living costs, and so forth, the actual expenditure, dollar for dollar, shows the following to be true:

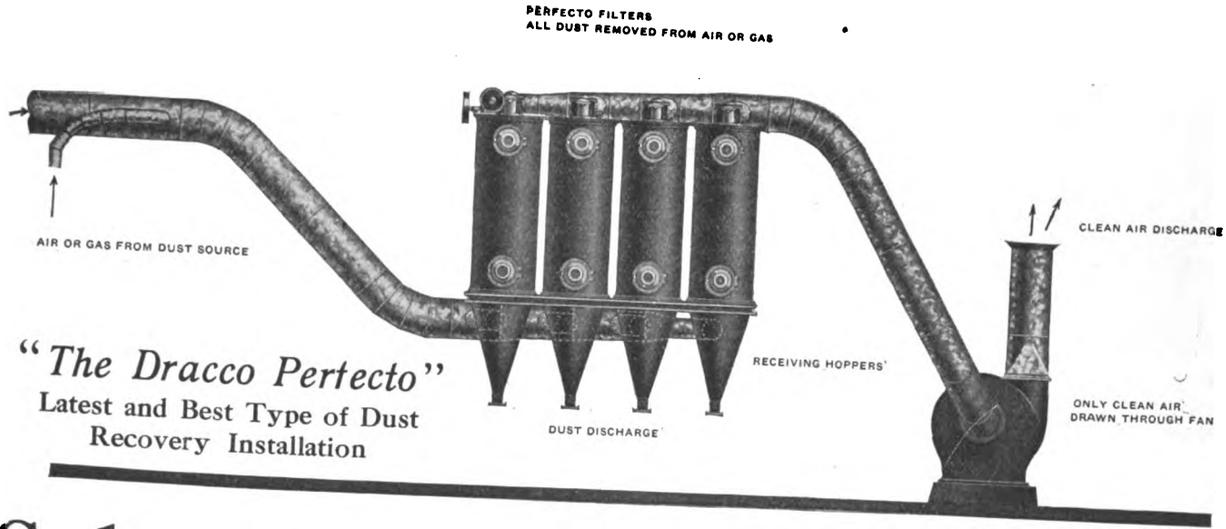
Southern California Edison Company Big Creek-San Joaquin project	$375,000,000
Construction of Panama Canal	360,000,000
Union Pacific Railroad	300,000,000
New York Subways	300,000,000
Nile River Irrigation Project	250,000,000
Terminal Facilities, Passenger and Freight, on New York and New Jersey side of Hudson, including electrical equipment	210,000,000
Catskill Water Supply System (for New York City)	162,000,000
Pennsylvania R. R. for New York City, Terminal and Extension	150,000,000
Erie Canal and Branches, 340 miles	139,214,969
Suez Canal	127,000,000
Proposed New Bridge over Hudson River	100,000,000
Alaskan Government Railway	52,000,000
Hetch Hetchy Water and Electric Project	45,000,000

The contemplated schedule of operations, in general, is designed to extract all possible hydro-electric energy from these waters by increasing the capacities of the reservoirs already formed, and diverting mountain streams and additional sources of supply into them. Then the capacities of the powerhouses already built can be increased and new powerhouses can be installed.

The project is under consideration of starting what is

(*Continued on page* 41)

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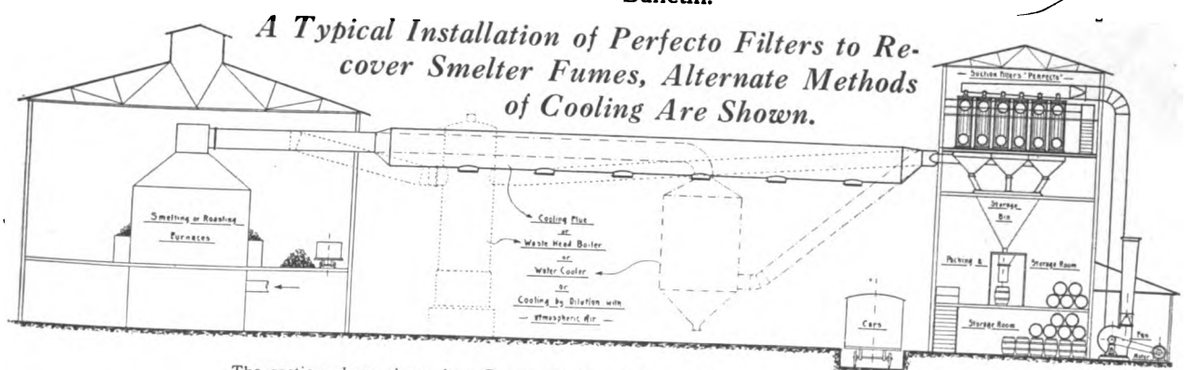
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(*Continued from page 38*)

known as the Pitman-Shaver tunnel, two and a half miles in distance, which will divert, as a first step, the waters of Pitman Creek into Shaver Lake. To impound this additional supply of water another dam is planned across the end of Shaver Lake which will raise the water about 55 feet above the present level, giving a storage capacity of 50,000 acre feet and making the elevation of the water line of the lake 5,330 feet.

While this work is in progress, it will be possible for the Company to increase the capacity of the third powerhouse, No. 8, from 30,000 horsepower to 60,000 horsepower; and to build a powerhouse designated as No. 2A, adjacent to No. 2, with an installed capacity of 70,000 horsepower by 1928.

Work on the great Florence Tunnel and the dam near the intake portal of the tunnel has progressed for over three years, and will be completed during the summer of 1925. After Florence Lake has been impounded and the tunnel completed, the extension of the Pitman-Shaver tunnel into Huntington Lake will make a complete tunnel connection from Huntington Lake to Shaver Lake. This will make it possible to store the flood waters diverted through Florence Lake and this new tunnel into Shaver Lake; and to meet this further demand on its capacity, the Shaver Lake dam will be raised 40 feet. This increased storage will make possible the increase of the capacity of Powerhouse No. 2A from 70,000 horsepower to 150,000 horsepower by 1929, and ultimately to 300,000 horsepower.

By the beginning of 1927 the storage capacity of Florence Lake will be 60,000 acre feet. This will regulate the flow of water through the Florence Tunnel into Huntington Lake, and the further diversion from Huntington Lake into Shaver Lake by means of Huntington Tunnel. At a later date, with a regulated flow of water from Huntington Lake to Shaver Lake, it will be possible to install a first and second powerhouse somewhere between Huntington Lake and Shaver Lake, with possible combined capacities of 134,000 horsepower.

This program brings what is known as the east-side project to its completion; and will make possible the probable increase of the generating capacities of all the powerhouses on the east-side up to their ultimate capacity.

When it becomes necessary, the waters from Bear Creek and from Mono Creek, on which is to be constructed the large Vermillion Valley Reservoir, will be diverted into the Florence Tunnel and used to supply the chain of powerhouses between Huntington Lake and Powerhouse No. 3.

In addition to this chain of powerhouses using the stored waters of Huntington Lake and Shaver Lake, other power sites, not using these stored waters, will be developed as Powerhouses Nos. 9 to 15, located on the Middle Fork of the San Joaquin River, offering an ultimate development of 180,000 horsepower under a head of 3,750 feet. The other groups, known as Powerhouses Nos. 9, 16, 17 and 18, is located on the main San Joaquin River above its junction with Big Creek, and is capable of a development of 135,000 horsepower at a head of 2,150 feet.

Eighty-six miles of tunnel is the dominating physical achievement of this mighty construction project. Engineering difficulties and problems encountered in building

(*Continued on page 43*)

MOTORBLOC

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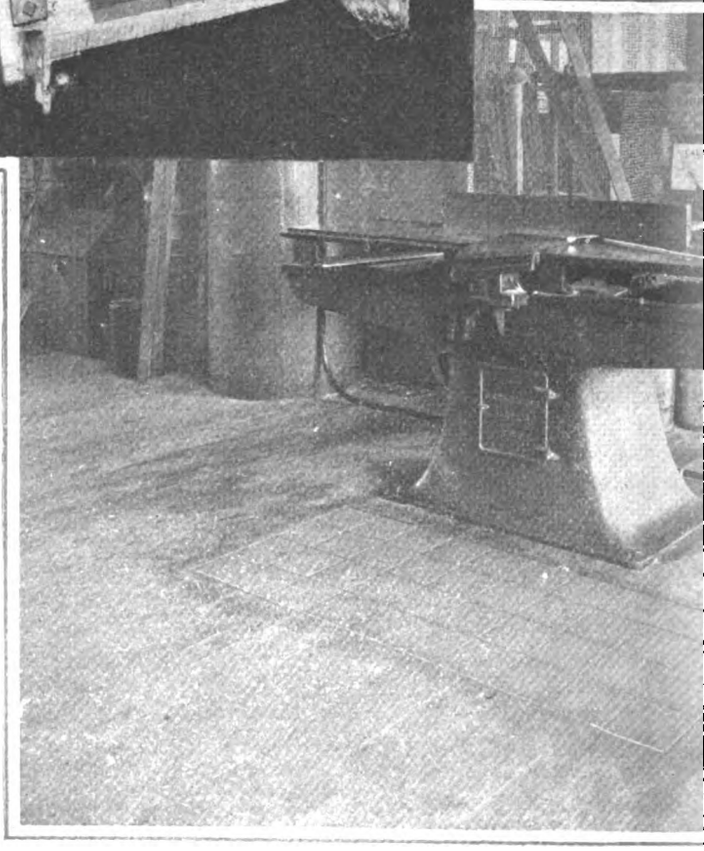
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PAPER

(*Continued from page* 41)

these tunnels under mountains ranging from one mile to a mile and three-quarters above sea level, are as great as those met with in the construction of the Panama Canal, which has a total length of fifty miles.

A general sketch of the method of procedure will reveal the practical manner in which the work is undertaken and carried through.

The first step in the location of a tunnel is the projection of the proposed tunnel on the government survey map, which gives the surface topography by contour lines. Especial care is given to securing the necessary overhead and side cover of rock, so that the static forces of water will not cause a blowout. After this projection is made, a reconnaissance of the territory is made as a check upon the work of the government topographers. This shows that the projected location is approximately correct.

Next, a very close survey of the lines must be made, since in order to complete the construction work in the shortest time it is necessary to start simultaneously at each end, and these two ends must absolutely come together at their junction point. To accomplish this, the ordinary transit is abandoned and the engineer's theodolite, an instrument of utmost precision, is used. When it is realized that all this must be done in a wild, mountainous region, across rocky cliffs, through heavy timber where the elevation varies from 7,000 to 9,500 feet, one can appreciate the obstacles encountered and the exactness of the work required to achieve infallibility.

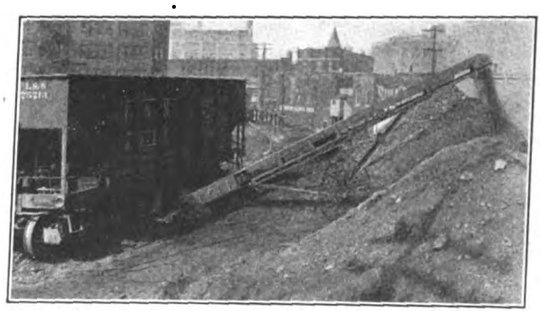
The art of tunnel drilling has advanced materially since the old days of the hand drill and the sledge hammer. Now it is done with pneumatic drills driven by air compressed by electrically driven machinery. The drills vary in length from six to twenty-one feet; the drill "steels" are an inch and a quarter in diameter with a bit at the end somewhat larger. Through their center is a bore, through which a continual flow of water is forced, keeping it cool while whirling at a steady rapid rate, striking the rock.

What is known as the "heading" and "bench" method is the one employed, the workmen standing on the bench, or lower half, while drilling into the heading, or upper half. The drill holes in the heading are arranged into four sets, in vertical rows. The inmost set converge, the next two sets cut slightly toward the center, while the outmost set, which circle the rim of the tunnel, cut slightly outward. The blasts are fired by an electric control which discharges the holes in the order given, first the inmost set and so on in succession until the rim holes are fired. Then, by hand labor and steam shovel, the muck is carried from the heading.

When two headings have been advanced approximately ten feet, then the bench is blown. This is done by drilling twenty-foot holes at the base of the tunnel, known as lifters, which blows up the bench. Steam shovels and trolley cars carry the muck from the bench, after which the process is started again.

In the driving of these tunnels it was found that there was no drill manufactured which was capable of drilling to the depth required. So one of the leading machine drill manufacturers developed a drill specially fitted for this work. After having been installed by experts, and explained to the operators, the drillers were enabled to cut down the time required to drill around the holes from one to two hours. Several other new departures have

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Fractional H.P. Motors

been made in the art of tunnel driving which have aided the progress of the work and added to this branch of technical science. Investigations and experiments in tunnel boring have not as yet proved success for this work. In this, the attempt is made to grind the entire bore in the tunnel, instead of blasting; the debris from the heading being washed out, instead of mucked out of the tunnel.

Close to the portal of each tunnel entrance and adit is the drill sharpening shop. The drill sharpening furnaces are operated by electric motor-driven air compressors. It is necessary to pass four hundred pieces of steel, varying in length from three to twenty-two feet, through the furnace and sharpener for each round in the tunnel. This is the Bessemer steel process in miniature.

The Southern California Edison Company is the largest consumer of high explosives of any organization in the world engaged in the same class of work. The chemical engineers of the powder companies have developed for this company a special grade of gelatine powder, notable for the small amount of fumes and gases it generates, thereby enabling the miners to get back into the tunnels after a blast in the minimum length of time. They have also developed a special size of cartridge, which will result in a more efficient shattering of the rock.

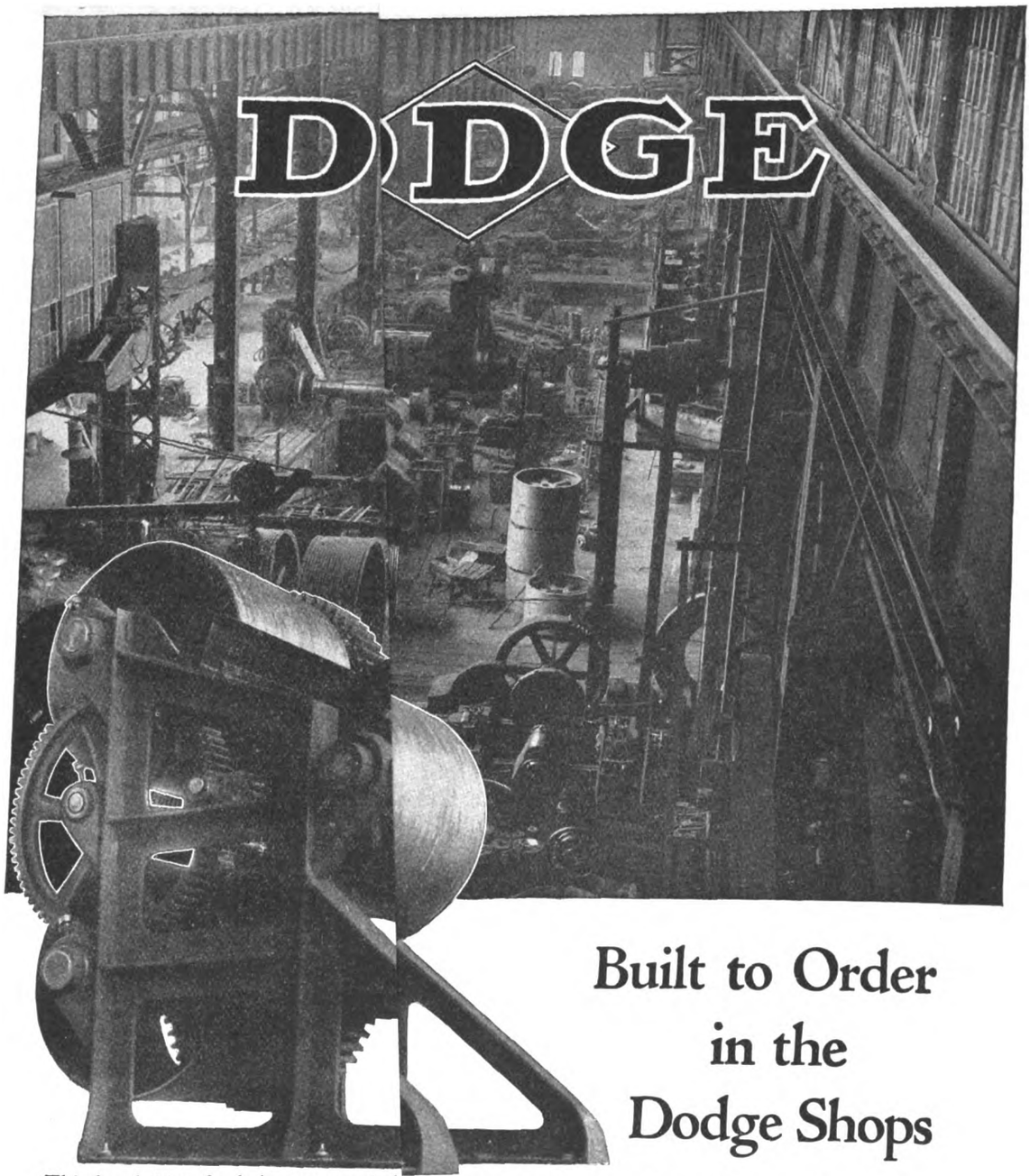
Approximately 5,330,000 pounds of powder have been used on the Big Creek project within the past twelve months; in the construction of Big Creek No. 3 alone 4,650,000 pounds were used. Near the portals and adits are the daily supply powder houses, and far back in the forests and on roadsides are located the seasonal powder houses, where sufficient powder is stored to carry on the work for the entire winter period.

World tunnel records have been made on this job, one of the most noteworthy being (on) the tunnel from the third powerhouse on the stream to the fourth. This tunnel has a cross section of twenty by twenty feet, is six miles long, and is hewn out of solid granite the entire distance, making it one of the largest hydro-electric tunnels in the world. The world's record made on this tunnel was in 1922, when 476 feet were driven from the heading in one month. Another wonderful record was made on the tunnel between Shaver Lake and Powerhouse No. 2, in 1921. This tunnel has a cross section eight by eleven feet and a distance of 522 feet was driven in one month. In Tunnel No. 6, the famous thirteen mile bore from Florence Lake to Huntington Lake, the remarkable distance of 125 feet was driven in one week.

The Florence Lake Tunnel, the second longest tunnel in the world, was started in 1920 and is now one-third completed; it will be finished in the Fall of 1925. It reaches from Florence Lake, at an elevation of 7,300 feet, under the Kaiser Range to Huntington Lake, at an altitude of 7,000 feet. Work is under way at the intake portal, where 2,300 feet have been drilled; at a lateral construction entrance (adit) about four and one-half miles below the intake, where the east heading has progressed 2,100 feet and the west heading 300 feet; and at another adit two and a half miles below, where the east heading, recently started, has been driven 350 feet and the west heading 9,600 feet; also at the outlet portal at Huntington Lake, six and one-half miles southwesterly, where the drillers are now working at a distance of 9,550 feet in from the portal. These distances are as of Sep-

(*Continued on page 47*)

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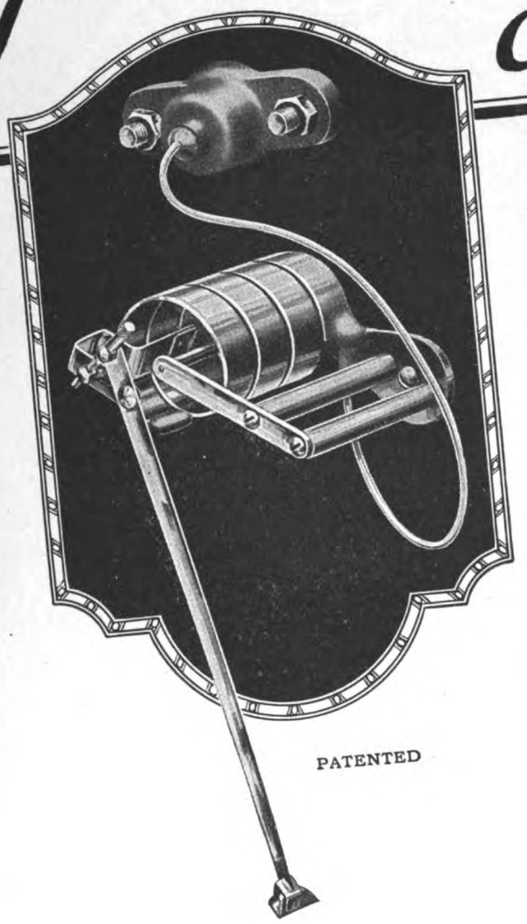
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(*Continued from page 44*)

tember 1, 1923. The average progress per day is twelve and a half feet per heading; the maximum amount driven during one day in any heading, working three shifts a day, is twenty-five feet.

Transmitting 220,000 volts of electricity from Big Creek to the suburbs of Los Angeles, a distance of 270 miles, marks the world's highest voltage record for commercial purposes. The line was first energized at this voltage on May 6, 1923, although originally constructed in 1913 for 150,000 volts, also a world's record at that time. The air surrounding the insulators breaks down under such high voltage, so it was necessary to install aluminum steel rings, and also to increase the clearance of the conductors from the ground and install additional insulators.

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At the time the Huntington Lake Dams were built and the first two powerhouses constructed, in 1912, automobile trucks were in the experimental stage and horses and mules were used for all heavy hauling. It is said the cost of hauling these materials by live stock exceeded the entire cost of building and equipping the San Joaquin and Eastern Railroad, which was built primarily for carrying material and workmen to the job. A world's record was made in the construction of 56 miles of standard gauge railway over the roughest type of mountain country and in high altitudes, when this road was completed on July 10, 1912, in six months' time.

On the mountain division the curves are so sharp that the drive shaft locomotive cannot be used upon it, so the power is supplied by a gear type engine, with an upright drive, somewhat similar to the engine of an automobile. These powerful little locomotives can haul tremendous loads, but cannot attain a speed of over fifteen miles; they have been nicknamed the "galloping geese." The maximum grade on the mountain division is 5½ per cent.

During the brief open season from June 1 to October 15, the automobile fleet of twenty-two trucks must haul all the provisions, powder, cement, coke and coal, drill steel, railroad iron, electrical equipment,—all materials for construction work on the tunnels and maintenance of the construction camps. For the season of 1923-24, 18,000 tons will cross over Kaiser Range to the intake portal of Florence Lake, a distance of thirty miles, and intermediate points.

Jerry Dwyer, an old Alaskan "sour dough," with his seven trained team dogs and sledge, has made daily trips across Kaiser Range to the marooned tunnel workers since 1920. These men must go into voluntary exile for months, and in order that they be not entirley cut off from the world the Edison Company sent to Alaska for Jerry and his team. Carrying books and letters from the outside, they break their way through snow drifts from 20 to 30 feet deep in face of blizzards keener than ever swept the Yukon.

The natural grandeur of this region, the snow-covered peaks, rugged cliffs, sparkling cataracts running through the heavy timber, the green glades of the meadows, all make this section one of unparalleled magnificence.

(*Continued on page 50*)



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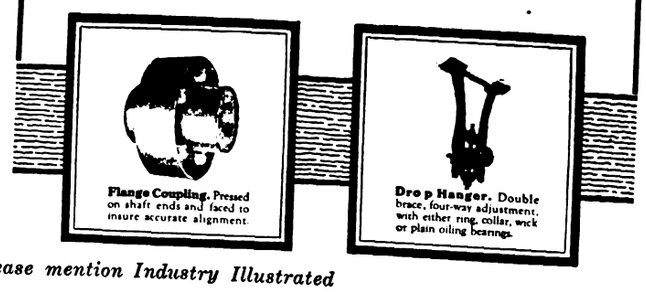
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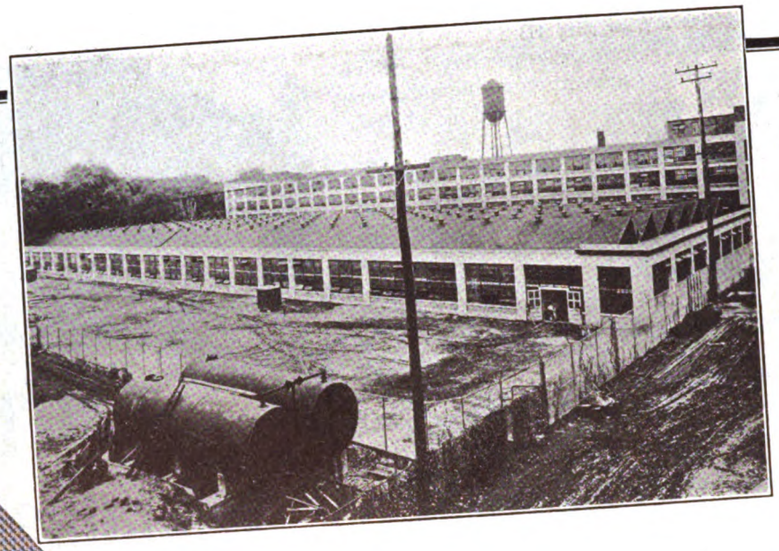
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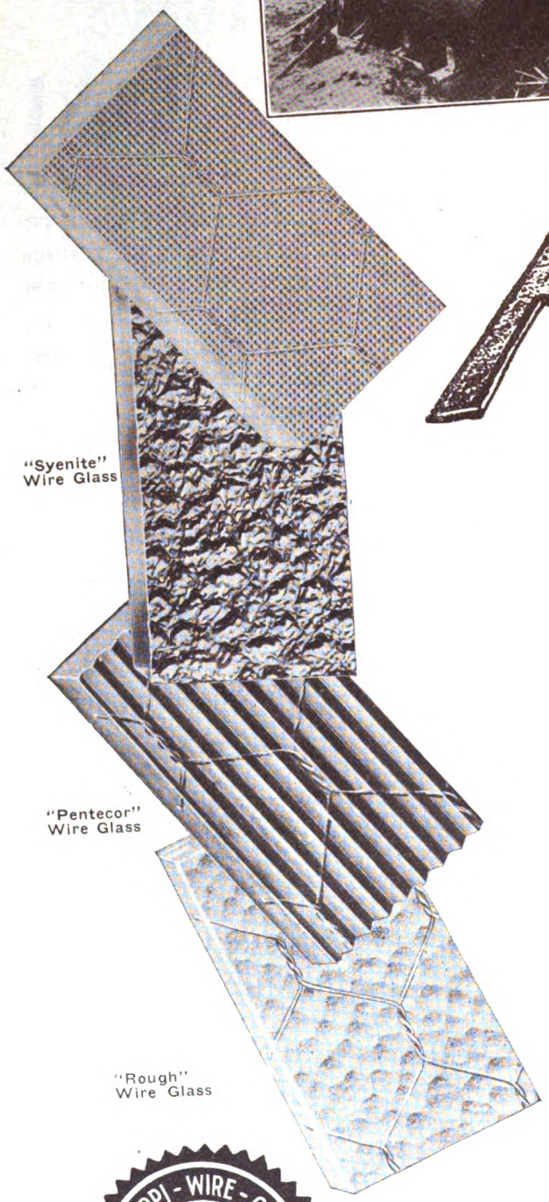
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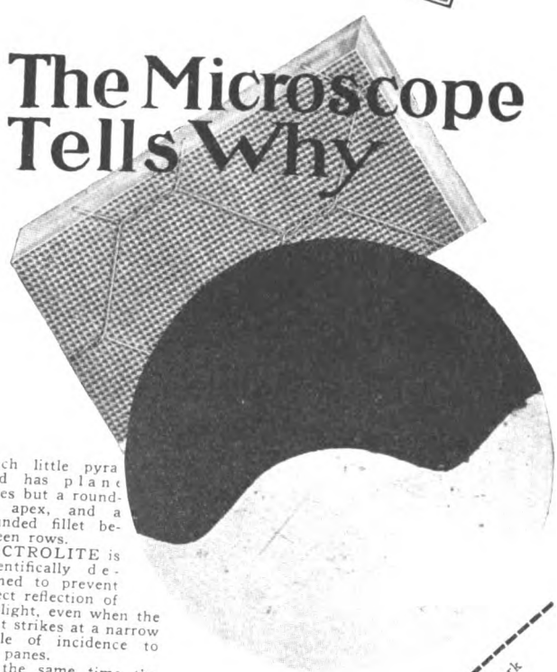
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AMERICAN Ring CRUSHERS

(*Continued from page 47*)

When this work is completed there will be given to the State and to nature lovers four beautiful mountain lakes, all within easy distance of each other. Huntington Lake is about five miles long and one mile at its widest point, and Huntington Lake Lodge, on its bank, is already a popular resort. Florence Lake, twenty-three miles distant by forest road, is about one-half its size, lying in a deep crevice between towering mountains. Vermillion Lake will be in the very heart of the most impressive mountain scenery in California. Shaver Lake, the largest of them all, with a water line of approximately fifty miles, will undoubtedly be one of the greatest pleasure resorts in the State. It is sheltered by surrounding mountains and is accessible for a much longer period of the year than the other lakes of higher altitudes.

These lakes will in coming years be a regular fishermen's paradise, for the State Fish and Game Commission has been stocking Huntington Lake and the streams tributary to the other lakes, with Loch Leven, Rainbow and Eastern Brook Trout, and will continue restocking all waters yearly.

The vast areas of timber in the San Joaquin-Big Creek watershed escaped the destruction of forests which many States suffered during the latter eighties, largely due to the fact that this district was at that time remote from the great lumber markets and far from transportation. Had the Sierra Forests been stripped of their trees, the precipitation from rain and melting snows would have rushed from the mountainsides in devastating floods, and there could have been no lateral irrigation and no hydro-electric power for Central and Southern California. But this area was withdrawn by the Government before any serious inroads could be made, and all tree-cutting is now directed by the forest ranger service, the rangers marking all mature trees every year.

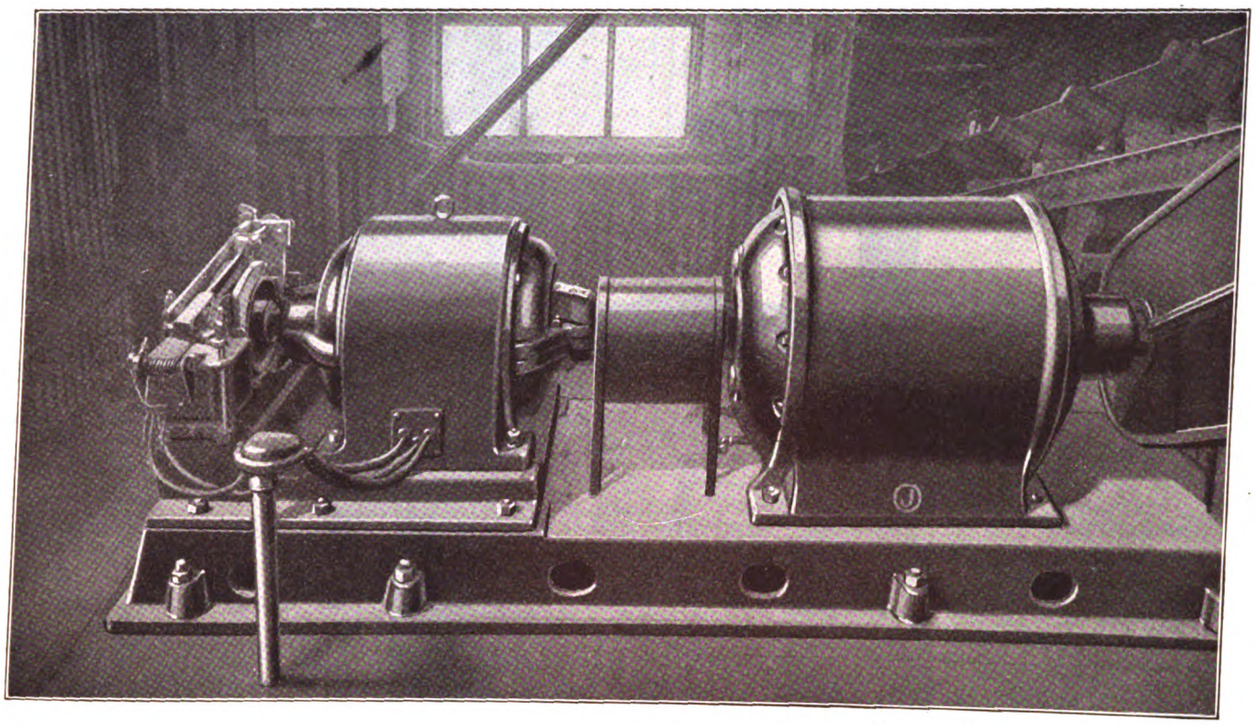
Permanent camps are located above the snow line, where extremely cold weather obtains. They are storm proof, heated with wood stoves, and make very comfortable living quarters. Along Florence Lake Tunnel, where the four headings are being driven, there are four of the five hundred-men camps. At the crest of Kaiser Range is a camp permanently intended as a shelter camp for the men or animals who are forced to take refuge from the severe storms and blizzards which sweep across its heights. At this camp, 9,300 feet above sea level, is located the world's highest radio station. There are also three large transfer camps for handling and transferring freight.

Cascada, the terminal of the San Joaquin and Eastern Railroad, started as a construction camp, and is now a thoroughly equipped municipality with a population of over 1,400. The headquarters of the project, administration building, accounting department, warehouse, general store, shops, garage, are located here. The city is complete in other respects, having a regular city government, grammar school, stores, as well as permanent homes for the engineers, department heads and operators of the powerhouses, recreation halls, and dormitories for the single men.

Temporary canvas tents are pitched in the warmer sections and follow the path of construction. Though often built almost on the sides of cliffs, water is piped to these tent cities and every attention given to comfort and

(*Continued on page 53*)

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A Jones Speed Reducer driving an inclined belt conveyor in a By-Products Coke plant. Motor speed 860 R. P. M.—Final speed 21.5 R. P. M.—Reduction ratio 40 to 1.

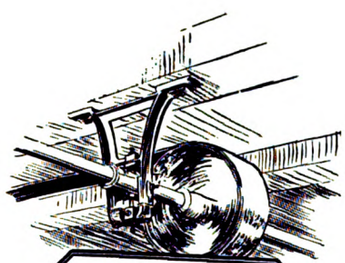
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Install the Calculagraph and this overhead leakage at once disappears. All of your people can operate it—one lever is pulled when the operator begins work, and the other lever when he stops.

Wipe out human error! Learn the many ways that the Calculagraph applies to *your* business, as told in our booklet, "Elapsed Time Records." Free on request.

The Calculagraph Company
34 Church Street New York

THE CALCULAGRAPH
THE ELAPSED TIME RECORDER

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(*Continued from page 50*)

cleanliness. They consist of dining room, club room, baths and sleeping cabins. As an illustration of the perfection of sanitation, the Company furnishes all the bedding, which is regularly cleaned, and after being used by one man, is fumigated and laundered before being given to another.

Providing meals for the five to seven thousand men engaged in vigorous labor requires eighteen cook houses and a large staff of cooks, bakers and roustabouts. To give some idea of the amount of food consumed in one month, there is needed 55,000 loaves of bread, 5,000 cakes, 36,000 pies, 210,000 pounds of potatoes and 219,000 pounds of meat.

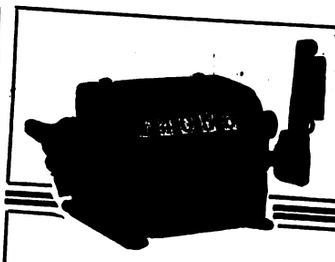
The medical corps has operated most efficiently in caring for the men, for in these camps the sickness and death rate has for years been far below normal, even during the influenza epidemic. There are three medical divisions, each having a principal hospital in charge of a physician and his assistants with emergency and dressing stations at each camp under the care of resident nurses.

As in all great enterprises that have a mighty achievement for a goal, coöperation has been, from the outset, the dominating feature in the actual development work. The construction army is organized very much on the lines of a regular army, and directed by men who have grown up with the job. All applicants are carefully selected and subjected to physical examination before entering the service. Advancement depends entirely on ability and loyalty, and many men have gradually worked themselves up to positions of great responsibility. Lectures on practical problems, educational courses in electrical subjects, and a circulating library providing information on technical details, encourage the men to perfect themselves in their profession and to look upon it as a life work.

Good living conditions, excellent food, commissary stores, amusements, all go to make for contentment and efficiency; and the keen zest of open-air work, and knowledge that they are playing a part in the accomplishment of this huge physical undertaking, have created a spirit of camaraderie among the men which is in no small degree accountable for the very small monthly turnover in labor. It is said that the record of labor turnover on most of the big projects comparable to this one have averaged as high as 100 per cent. per month. But under the plan of permanent organization, the labor turnover on this work has been constantly decreasing, until the average for the last year was 40 per cent., and the lowest average for any month 25 per cent.

Another factor which has greatly stimulated the employees to increased effort and the desire to eliminate small wastes, is the stock selling program whereby employees can purchase stock on a monthly basis, and thus consider themselves partners in the enterprise. Taking the organization as a whole, executive, operating, commercial and accounting, about 98 per cent. of the men and women of the Edison system are participating partners, and this tendency is spreading among the construction men as they see their work before them for the next ten or twelve years.

As a result of this concerted effort, and in recognition of the progressive spirit which the Company has displayed, the Southern California Edison Company was awarded the Charles A. Coffin medal for "the greatest



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SPEED UP PRODUCTION! The word goes down the line until it reaches the operator. If there's a *Productimeter* the message goes over—he knows, and you know, what has been done. If he exerts greater effort—beats the established record—the world knows it at once. It's the psychological effect of this little *Speedometer of Industry* that spurs the workman to greater effort—that helps to "speed up production." Name the machine you'll use it on, and we'll send you a *Productimeter* for a month's free trial.

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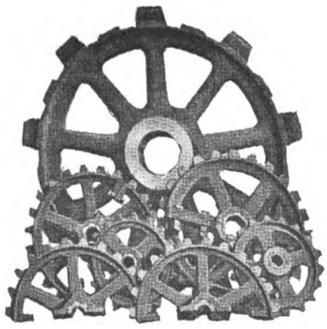
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Recognized as the standard in manganese steel. Records of its performances show durability from five to fifteen times as long as malleable iron.

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Made From Wharton Special Cylinder Steel Billets

Six exacting inspections during manufacture, and a final hydrostatic test.

Delivered promptly, complete, with or without caps and valves.

For oxygen, acetylene, hydrogen, carbonic acid, nitrous oxide, sulphur dioxide, liquid chlorine, blaugas, etc.

Manufactured rigidly to standard British and American specifications, with safety and endurance factors beyond requirements.

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contribution to the development of electric light and power for the convenience of the public and the benefit of the industry for the year 1922." This is the first annual award of the medal, to which all public utility companies in the United States were invited to compete. The points considered are: Outstanding technical achievements, improvements in service methods, extension of lines into new territory, relations with consumers and advance in the plan of consumer partnership. In addition to the medal, the sum of one thousand dollars is contributed for the benefit of company employees.

Development work on this great project is thus moving steadily onward, meeting the power requirements of this remarkable section of our country, and aiding materially in its growth. In 1935 the ultimate capacity will have been attained, generating sufficient electrical energy for a population of 5,500,000.

FINANCIAL and business circles recently have been stirred by the revival of the old question as to who stands the loss, the maker of a check or the bank, in the event of loss from check fraud. The interest in this question has been aroused by articles which contribute nothing toward its solution, but merely add to the literature of controversy. It is said that the salesmen of check-writer manufacturers are quite generally stating that the maker is responsible for the loss, whereas the other group argue that the bank is responsible. Each side cites cases to prove its point.

Probably as many court decisions have been rendered on one side as on the other. Unfortunately no body of law has as yet been built upon such precedents, and as there is no uniformity in state laws in the matter of liability it may be that a Federal statute may be required to cover the whole question. Decisions, for the most part, are rendered by juries on the basis of the individual circumstances attending each case.

The only certain guiding points in the laws governing such cases are that the burden of proof that a check actually has been altered as claimed, rests upon the maker, that the bank was negligent in paying such check, and that the blame for loss on a forged or altered check rests upon the one who was "negligent." Against the operations of skilled forgers it is usually very difficult to establish satisfactory proof of forgery or alteration, unless the mechanical protection afforded the check has been such as to make his work so obvious that acceptance of the check by the bank was palpable negligence.

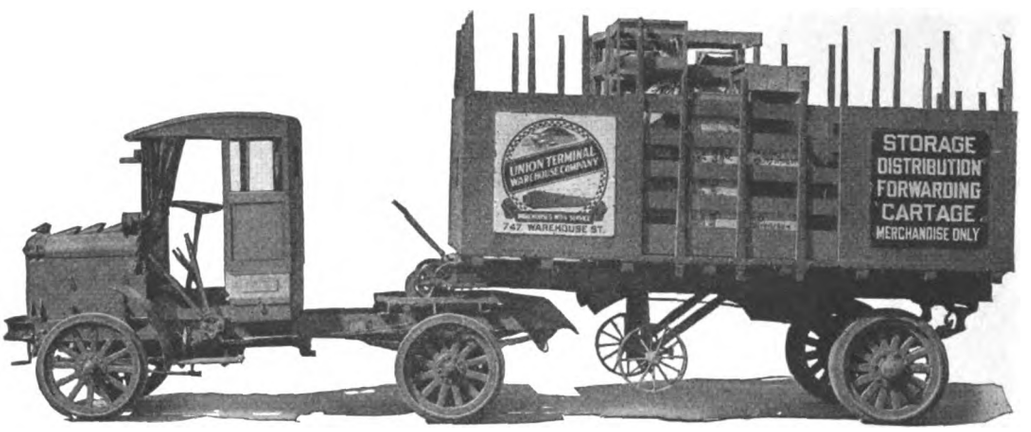
The question of responsibility, it would seem to the business observer as a matter of sound practice, is merely incidental. The real issue is whether or not steps to prevent losses from check fraud are worth while, and experience would seem to indicate that they are very much worth while. Check protector manufacturers sell machines today which shred the amount in two colors, and make alteration impossible. This automatically removes one of the commonest forms of check fraud—namely, the raised check.

In the face of numerous safeguards it would seem that the modern business man can so protect his negotiable instruments that possibility of lawsuit is largely removed, and, in addition, the business man has taken a long step toward removing the temptation from his employees and others toward the commission of check fraud.

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LAPEER SEMI-TRAILERS

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Trebled hauling capacity of the power unit!
Reduction of hauling cost to one-third!
Elimination of lost time during loading and unloading!
Complete control of trailer from the tractor cab!

You Will Be Interested In This Folder!

We have just published a folder showing in photographic detail the many remarkable mechanical features of Lapeer Semi-Trailers. We shall be pleased to send you one.

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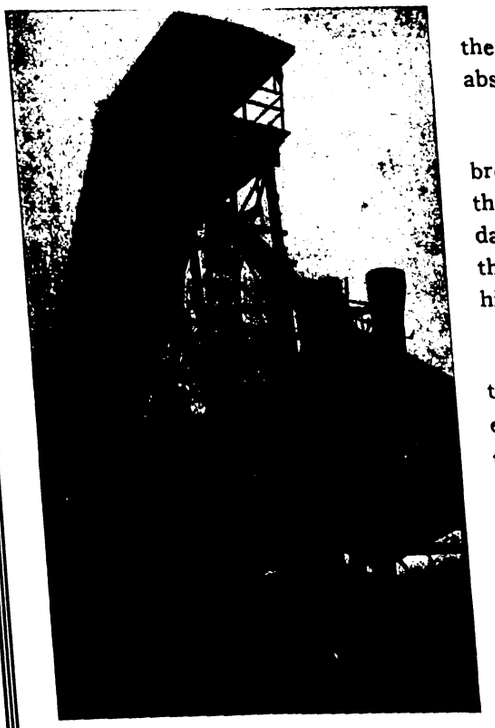
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LAPEER, MICHIGAN

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The Future of the Business



Here is an installation in Plant "B," Detroit City Gas Co., that has proven profitable to its owners and admirably suits their particular requirements.

Coal is elevated by a Hunt Pivoted Bucket Conveyor and discharged through a chute into tank shown at the right, from which it is loaded into Hunt Industrial Cars and taken to storage bins.

WE DESIGN AND BUILD:

Industrial Railways, Automatic Railways, Cable Railways, Cars, Tracks, Switches, Motor Cars, Scales, Conveyors, Skip Hoists, Electric Vibrating Screens, Cut-Off Valves, or Gates, Weighing and Measuring Devices, Coal Crackers, "Stevedore" Transmission Rope and Hoisting Rope.

What hopes and fears are conjured up in the mind of the industrial executive, when contemplating this all-absorbing problem.

In retrospect he visions the humble start; the heart-breaking efforts "to get the business on its feet." Then the steady expansion; until that never-to-be-forgotten day, when he could direct, from his own private office, the management of the business to which he had given his best years.

As he reviews the past, he notes the gradual transition from laborious manual labor to his present machine equipment. And realizes it is to his foresightedness in this respect that success was accomplished.

The white-haired executive will remember how every industry welcomed the result of C. W. Hunt's inventive genius over half a century ago, when he placed his pivoted bucket conveyor on the market.

Here was an invention destined to revolutionize the handling of coal and ashes, and similar bulk material. To make it less laborious, to do it more efficiently in the shortest time and at a substantial reduction in cost. He knew the savings made in this operation added to his profit and aided in volume production.

For this reason he,—and his successors,—have a kindly feeling for Hunt Cost-Cutting Equipment. It has truly borne out its name and cut costs wherever installed.

Let Hunt Engineers plan for the present generation of industrial executives, a system of coal, ashes and bulk materials handling, that in years to come will reflect the wisdom of their predecessors.

C. W. HUNT COMPANY, Inc.

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The Versatile Industrial Crane

(*Continued from page* 33)

and equipped with two trolleys and hooks is shown in Fig. 20 operating in a building where heavy machinery is installed. When used in this capacity or in power houses, the crane eliminates entirely the necessity of heavy lifting. The services of the crane in these installations has a great effect on the low cost of repairing, overhauling, and installing manufacturing equipment. The savings are brought about in many ways. First, they save days of time; second, they eliminate a number of extra men that would otherwise be required to erect rigging, scaffolding, etc. Thus the crane simplifies handling, cuts down labor costs, and speeds up the work. These simple and even the more expensive cranes, when employed in like manner have frequently paid for themselves by savings effected in one overhauling or the installation of equipment.

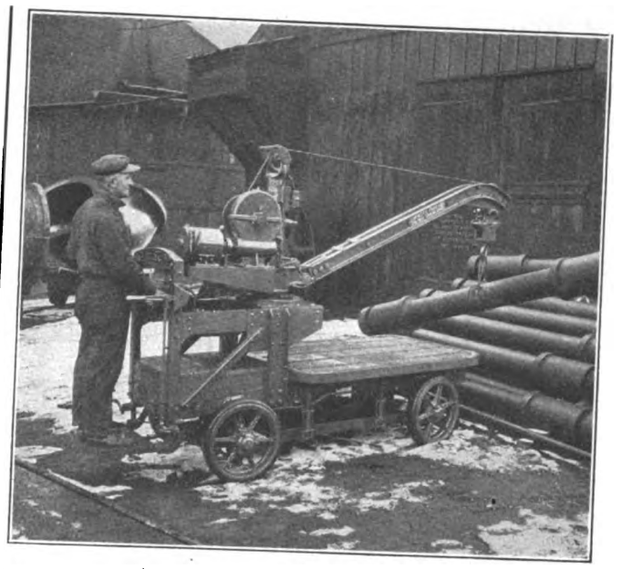
Electric overhead traveling cranes of medium and heavy capacities are generally equipped with an operator's cab suspended from the bridge either at one end, or sometimes in the center as shown in Fig. 18. The various switches, controllers, etc., are installed in the cab within easy reach of the operator. Because the operator is so high or removed from the working floor in this type of crane it is well to adopt proper rules and regulations for signals, etc., so as to eliminate accidents. It is not only necessary to educate the crane operator in the proper use of these signals but the workmen about the building served by the crane should also be instructed and compelled to obey them. A code of safety standards for cranes has been prepared by the American Society of Mechanical Engineers Sub-Committee on the Protection of Industrial Workers, which should be studied by the plant safety man and adopted wherever cranes are used.

Fig. 23 shows a shop well arranged for the use of a traveling crane, and the necessity for proper signals in its operation should be apparent. It will be noted that the balconies on the second floor extend beyond the crane tracks. This permits loads to be deposited directly on the second floor from the crane hook without rehandling. Attention is directed to the crane runway and its relation to the center of the building which permits maximum service. The construction of the building being of wood it was necessary to provide additional columns for supporting the crane track, but in the case of steel buildings the crane columns and building columns are one as shown in the other illustrations.

The layout of crane bays is an important factor in the proper operation of the equipment and for general manufacturing buildings, chemicals, plants and process buildings of more than one floor, the layout as shown in Fig. 23 will be found best adapted to the crane needs. In the case of warehouses, foundries, locomotive works, shipyards, etc., the crane bays and runways as shown in Figs. 18, 19, 22, 24, 26 and 27 will be found more advantageous.

Most steel mill cranes are special, but related industries such as steel warehouses, structural shops and rolling mills can use standard equipment. Fig. 24 shows a cab-operated overhead traveling crane installed in the warehouse of the Colburn Machine Tool Company, Cleveland, Ohio. Here flat steel, steel shapes, cold rolled

(*Continued on page* 61)



The "Handy Man" of the Shop

WHILE every type of Crescent Electric Industrial Truck is designed to overcome a specific transportation problem, it is also true that each type can be used for a variety of operations within its scope.

The uses to which the Crescent Crane Truck shown above can be put are self suggestive. For piling, carrying, moving, lifting heavy or unwieldy objects, it is ideal. Like all Crescent Trucks, it can operate within a narrow radius; it is built with an eye to superior workmanship and a knowledge of the conditions it meets in every day service.

Our engineers will be glad to call and help you solve your carrying problems —without obligation on your part.



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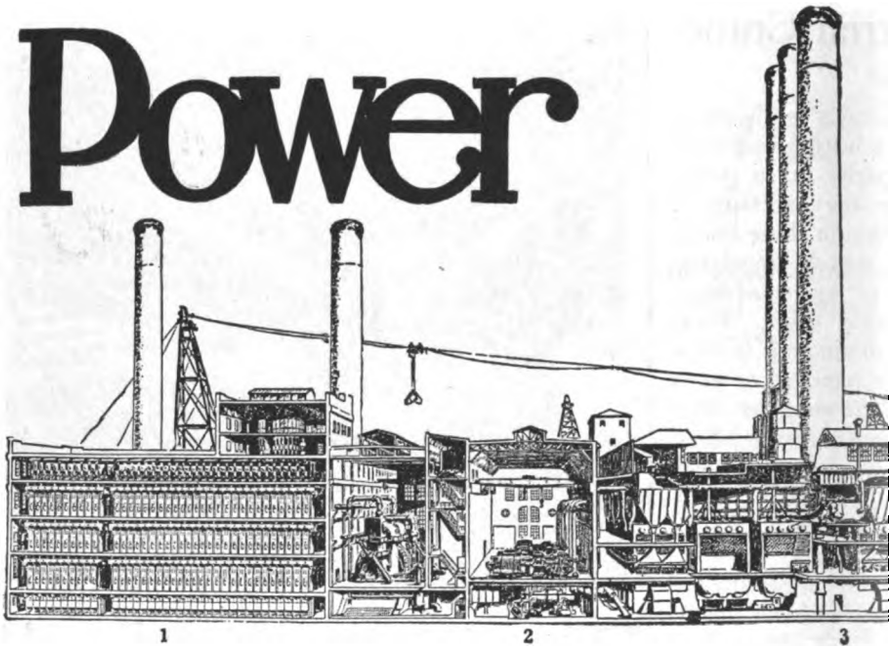
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The progressive character of the Consolidated management is indicated by its extensive advertising campaign, impressing upon Baltimoreans the value of good public service.

Forty Edge Moor Boilers totalling more than 40,000 H.P. supply the steam used by seven great turbines in generating Baltimore's electricity.

Executives of other progressive plants will find much of interest in the Edge Moor catalogue—sent free upon request.



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FOR INCREASED FUEL

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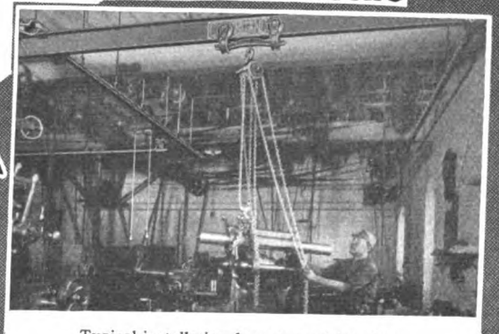
Removing carriers from ovens

Gangway or Headway?

Is it a small thing—
to allow monopoly or even partial monopoly of floor space, labor, and time by a corps of floor truckers.
The ceiling is the highway for headway in material handling when its purloins support a Cleveland Tramrail system which is absolutely flexible and adaptable to any and all conditions.
May we look over your plant and make our recommendations to you?

CLEVELAND TRAMRAILS

HAND OR ELECTRIC



Typical installation for any machine shop



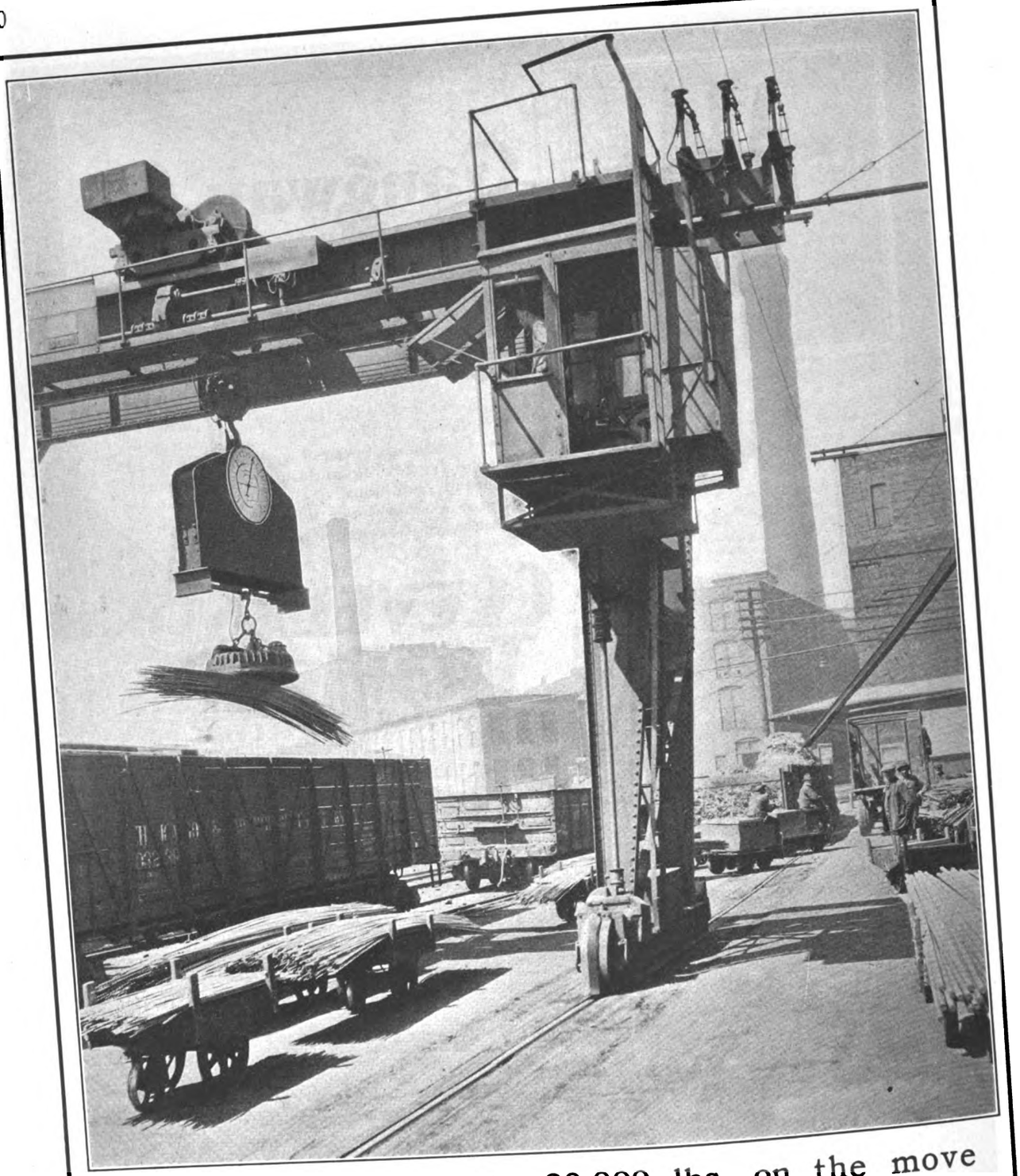
Tramrail in stock room piling bales



Tramrail equipped with push button control shipping blocks in a wire mill

CLEVELAND ELECTRIC TRAMRAIL
Products of
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO

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Weighs Materials up to 30,000 lbs. on the move

This Kron Crane Scale, at the International Harvester Company's Chicago Plant, automatically weighs all materials unloaded by the electro-magnet. No extra attendant required. A weighing problem such as this is only one of the many that the various types of Kron Scales have solved.
Let us help you solve yours.

AMERICAN KRON SCALE CO.,
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(*Continued from page 57*)

shafting and other steel parts are stored. Because of the unwieldy nature of the products and their weight, the crane equipment is the most efficient that could be installed. The use of racks permits the crane operator and one man to place the materials in or take them out of stock. Attention is directed to the high, light, airy building which makes for ideal crane operation.

Foundries are extensive users of electric and hand-operated overhead traveling cranes and the reasons for this are apparent if we look at Fig. 22 which shows how the foundry floors are cluttered up with miscellaneous flasks, castings, sand piles, etc. These conditions make it difficult to truck or move things on the floor, but as the crane moves above the floor it has a clear passage at all times and can quickly raise the load, transport it and lower it again without assistance or loss of time.

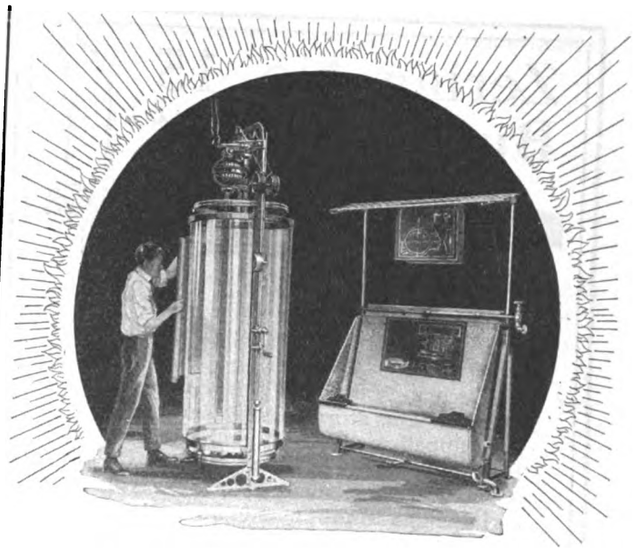
Many old foundries and other shops are doing without the services of overhead cranes because they feel that the cranes require too much headroom to fit into their old buildings. This is often true of standard cranes, but in such cases, for practically the same cost, special low cranes can be designed and installed. Fig. 19 shows such a crane in the plant of the U. S. High Speed Steel & Tool Co., at Troy, N. Y. This crane was designed primarily for use in an old low building where no provision had been made for crane service. This crane is a typical heavy duty steel mill design, built for the hardest service and yet when installed in a low building gives practically the same clearance under the crane hook as would be obtained if a standard crane were used, and the building were three or four feet higher. Though this crane has a 51-foot span it only requires 2 ft. 6 in. headroom and thus the crane hook when in its highest position is only 3 ft. 8 in. below the highest point of the crane.

Other industries have overlooked the possibilities of the crane because they feel that the span is more or less limited and that intermediate columns for crane runways would interfere with the proper movement of materials within the building, and would take up valuable floor space. Figs. 18 and 26 illustrate what can be done in the way of crane spans. Fig. 18 shows a 5-ton 97 ft. 6 in. span overhead electric traveling crane in the plant of the Bridgman Co., Philadelphia, used for the loading and unloading of cars. Fig. 26 shows a 125-ton 97-ft. 5½-in. span overhead electric traveling crane handling locomotives in the shops of the Chicago, Burlington & Quincy R. R. at Denver, Colo. While these illustrations show two extremes as to capacity, there is no difficulty in meeting requirements between these limits.

Overhead traveling cranes operating in shipyards have to be supported on specially built runways. Fig. 27 shows the cranes over one of the ways at the Bethlehem Shipbuilding Corporation, Fore River plant, Quincy, Mass. It will be noted that the cranes operate on tracks placed at two different heights. The longitudinal and transverse movement obtained by using this type of crane permits materials to be handled to any point in the ship way.

As previously stated one of the most common types of cranes is the locomotive traveling crane which is to the industrial plant yard what the overhead traveling crane is to the industrial plant building. Figs. 11, 12 and 16 show three different types of locomotive cranes, on as many different operations.

Fig. 11 shows a locomotive crane electrically operated,



The Eclipse of the Sun

As far as blue printing is concerned was a demise and took place when the Pease Vertical and Pease Peerless Blue Printing machines were invented. Nowadays sun printing is practically obsolete although there are a few blue print users who still depend on uncertain Old Sol.

Blue Prints at Low Cost

The Pease Vertical Blue Printing Machine and Sheet Washer and the Pease Peerless Equipment with their exclusive features have just about forced Old Sol into a total eclipse. The combination illustrated is an ideal equipment for the engineer and blue print user who requires a reasonable amount of blue prints at low cost with a moderate initial investment.

Blue Printing Machinery

Drawing Materials

Drafting Room Furniture and Supplies

Drawing Instruments

"Instructions for Making Blue Prints"

is the name of our new booklet which not only tells the complete story of the Pease Vertical but also explains in detail modern methods of producing blue prints.

Shall We Send A Copy?

The C. F. Pease Company
828 N. Franklin Street
Chicago, Illinois

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Zering No. 15 Built to Last



A truck is only as serviceable as its casters. This sturdily built Zering No. 15 is equipped with Champion Plate Casters. Bolster breakage is eliminated, costly repair and replacement bills are avoided, and damage to products is minimized.

The rails are tenoned, grooved and securely bolted to side rails. Heavier loads are handled with less effort. Made in all sizes. Write for complete information.

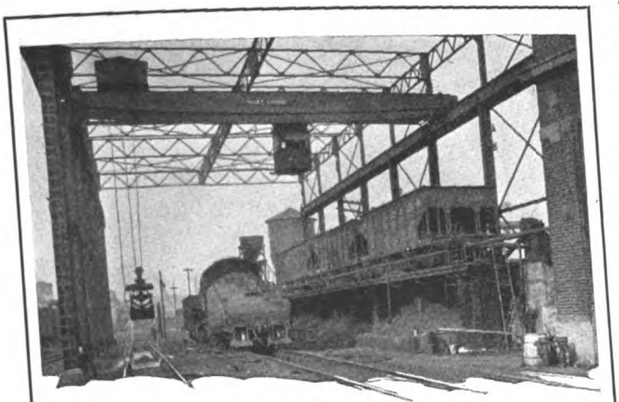
The H. Zering Manufacturing Co.
4425 Enyart St., Oakley Station, Cincinnati, Ohio



Patent Pending

Manufacturers of trucks, trailers, skids and casters.

Champion adjustable double race casters are used on all Zering ball bearing trucks.



NILES CRANES

Handling Ashes at Railroad Terminals

THE superiority of electric traveling cranes and grab buckets for speeding up and cutting the cost of handling and loading ashes at terminals has been demonstrated by some of the largest railroads of this country. Niles Cranes have done a large part in making such installations successful.

Their unusually rugged electrical equipment and husky lifting gear, their ease of handling, their reliability under severe outdoor conditions and under continuous service has splendidly equipped them for just such work.

Niles Cranes are made in all sizes from 5 to 250 tons and larger, and electric traveling, jib, wall, and gantry types. Built in a plant that makes cranes *exclusively* and that has twenty-five years experience in crane construction behind it to ensure highest quality.

Our Catalog will show you how to use Niles Cranes to save you money. Send for it.

NILES-BEMENT-POND CO. 111 BROADWAY NEW YORK CITY
CRANE WORKS — PHILADELPHIA

handling coal from storage pile to power house bunker. It is unusual to find this type of crane electrically operated, but if electricity can be obtained at reasonable cost there is no reason why such operation should not be both satisfactory and economical.

Fig. 16 illustrates the overhanging boom type of locomotive crane used for handling lumber in unit packages. This crane is steam operated, which is the usual method of obtaining power. These cranes are located at the Vart Hardwood Company and their record is as follows:

Two 18-ton overhanging boom cranes handle from 225,000 to 250,000 feet of lumber daily, using six men.

From 75,000 to 100,000 feet of lumber is handled from sorter to stacker.

From 15,000 to 30,000 feet of timber and ties from timber dock to loading dock.

From 50,000 to 75,000 feet of lumber from stacker to yard.

From 15,000 to 30,000 feet from kiln to loading shed.

From 50,000 to 75,000 feet from yard to loading shed.

It will readily be seen that these cranes play an important part in the final cost of lumber, as high handling costs would naturally make for higher finished product costs.

Fig. 12 shows a gasoline-driven locomotive crane mounted on a caterpillar tractor and operating on the dock of the Liberty Trucking Company at Staten Island, N. Y., on the operation of unloading barges. It is estimated that a 52-gallon barrel of gasoline will produce approximately two days' work with this machine. With a steam-drive locomotive crane of the same size it is estimated that one ton of coal would produce one day's work. Figuring gasoline at 20 cents per gallon and coal at $8 per ton the difference in fuel costs can be easily compared.

When using cranes it is necessary to pay attention to what is on the crane hook, in the form of a lifting medium, as it is to select the proper crane for the particular operation or building condition. Different types of lifting medium, such as magnets, grab buckets, slings and special devices are shown in Figs. 5, 13, 14, 15, 16, 26 and 32.

Fig. 5 presents a special sling designed to handle a roll or large object having a hole in the center. Fig. 13 shows the well known grab bucket with which we are all familiar. Fig. 14 shows a magnet handling steel shavings, the magnet can also be advantageously used for handling pipe, sheet iron and structural shapes. Fig. 15 shows a special grab device designed to handle ties and other loads of a similar nature. Fig. 16 shows special slings designed to handle lumber in unit packages to facilitate quick pick-up and placing. Fig. 26 shows special slings for handling locomotives; it will be noted that on the hook of each crane a different type of sling is required so as to properly pick up the load without twisting or straining. Fig. 32 illustrates what is known as a large capacity bucket for handling bulk materials.

To give the details of each crane operation and to describe in full the uses of each type would require many separate articles. For that reason descriptions are more or less meager, but the readers can obtain additional information if desired.

Cranes that are not as common as the above mentioned

(*Continued on page 66*)

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Today's fallacies were yesterday's facts

WHAT was fact yesterday is not necessarily true today. For example, Steam was once admittedly the most economical method of heating for all industrial buildings. In a certain type of building, and in some localities, its economy is still undisputed. But this no longer applies universally. Due to improved and more efficient engineering, hot water, in many types of buildings, will effect fuel savings from 20% to 50%.

Yet the belief that the first cost and operating costs of hot water are excessively high—a belief based on calculations so old that their ink has faded—persists with such tenacity that the majority of manufacturers and building owners let contracts for heating systems without even inquiring into hot water's cost. The result is wasteful steam systems.

If modern factories are to be operated on a rock-bottom economy basis then manufacturers and consulting engineers must get the exact figures on hot water heating—compare them with exact figures on other systems—before the contract for a heating system is awarded.

Consider it on this basis! The mean temperature for five Northern cities (shown on the chart at the right) from October 1st, 1922, to April 30th, 1923, was 40½°. Sixty-eight degrees is a comfortable, healthful temperature. It can be maintained with the thermometer outside reading 40½° by sending water into a properly engineered hot water heating system at a temperature of 145° to 155°. And on the colder days—days when the thermometer goes below the mean for the season—68° can be secured by increasing the temperature of the water only a few degrees, still keeping it well below the 212° needed to produce steam.

With any steam system you must spend good money for tons on tons of coal to produce an unnecessarily high temperature every day. For with steam you must have 212°—or you get no heat.

Hot water gives the right amount of heat—and *no more*. It gives this exact heat when the outside temperature calls for it—not before or after. It cuts coal bills anywhere from 20% to 50% or more. But in the last analysis these advantages are governed by the engineering skill with which the system is planned and installed. Improper engineering produces inefficiency in any type of heating system. The best results—and the most economical—are obtained only by experts.

For more than seventy years Grinnell Co., Inc., has specialized in industrial heating and piping. Grinnell Engineers are fully equipped to cooperate with you and your consulting engineer or architect to eliminate waste from your heating costs. If you want the truth about heating write us. Address Grinnell Co., Inc., 307 W. Exchange St., Providence, R. I.

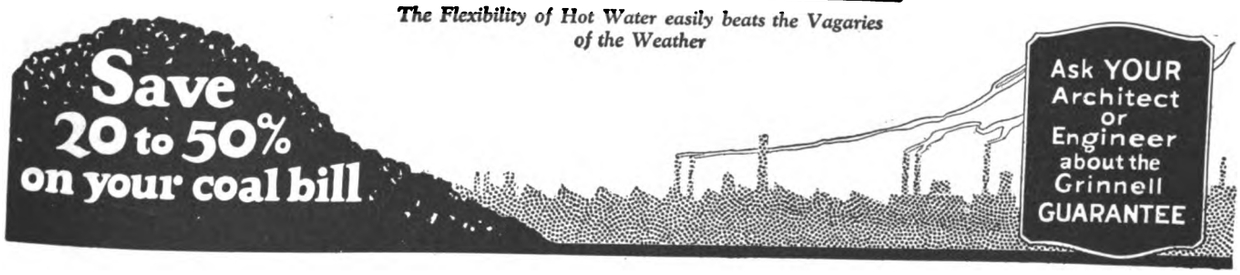
This chart is compiled from U. S. Weather Bureau reports

Weather for 1923 Heating Season

Averages in New York, Boston, Chicago, Pittsburgh and St. Louis

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Highest temperature, degrees F.	87	68	61	55	50	71	82
Lowest temperature, degrees F.	34	24	6	12	4	6	16
Mean temperature for month, degrees F.	58	46	34	32	28	37	50
Greatest daily range, degrees F	29	24	29	29	26	37	38
Least daily range, degrees F.	6	5	5	5	5	7	6

The Flexibility of Hot Water easily beats the Vagaries of the Weather



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Don't Waste Men
—on Material Handling Jobs

IN many a concern and many an industry, the loss of a nickel's worth of material is a great offense, while the waste of men is suffered without the batting of an eye.

This is neither logical, humane nor profitable. Wasting men by keeping them at unproductive work when machinery would do it faster, better and cheaper is indefensible.

The better way—the American way—is to concentrate men upon productive work at better pay, and let iron and steel in the form of Material Handling Equipment attend to the moving of materials.

The results that have been accomplished in some industries and by some individual concerns should be an inspiration and a challenge to others.

Handling material by mechanical means benefits both worker and employer; permits you to better place your own labor; the dollars invested in labor are made to yield a higher dividend, and workers are benefited by being engaged at more profitable tasks.

These advertisements are addressed to those executives who want their own concerns to secure the rich rewards that flow in any industry to the earliest users of improved methods.

THE JEFFREY MFG. COMPANY
Mining and Material Handling Equipment
COLUMBUS, OHIO

Material Handling EQUIPMENT

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(*Continued from page 62*)

are pillar and jib cranes which are practically identical in method of operation although slightly different in construction. The pillar crane is a rotating type of crane as shown in Fig. 5 and is used under conditions as shown for loading and unloading materials and for general lifting purposes within a limited area. These cranes can also be installed indoors and used for many of the same purposes as a jib crane, but as it is necessary to erect a self-supporting pillar the jib crane is more frequently used, and fastened to the building wall or column.

Fig. 7 shows how the jib crane operates within the building for lifting heavy castings to drill presses, planers, milling machines, etc. The use of this device saves many thousands of dollars per year for American industries by eliminating idle production machine time, speeding up the operation, thus speeding up production, elimination of accidents to proficient and skilled workmen, and in many other ways. Jib cranes can also be installed in the yard as shown in Fig. 8 and they will quickly save their cost in loading and unloading materials from trucks used for intra-plant transportation and for inter-plant transportation.

Derricks are a form of crane and for this reason they are installed to perform many of the same operations as a crane, and when the service required is within their scope, they may be used to advantage as a component part of the materials handling equipment in construction work, railroad yards, shipyards, coal, lumber, or other storage yards, foundries, quarries and in many similar operations.

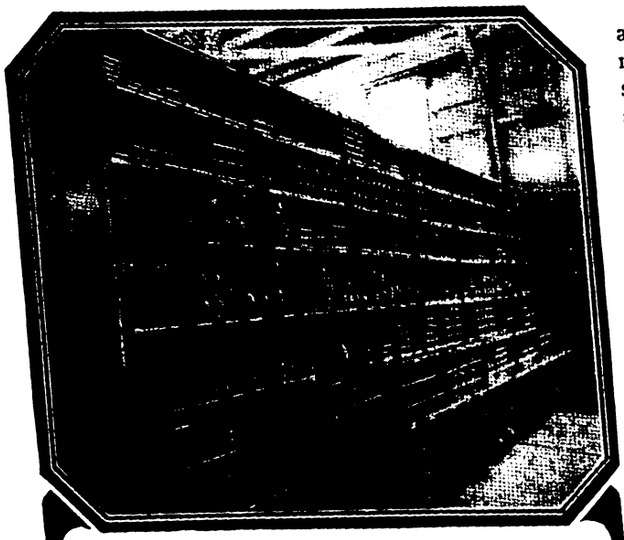
The steel derrick shown in Fig. 9 is used in the log storage yard of a lumber mill. The donkey engine brings the train of cars within reach of the derrick boom and they are unloaded and the logs piled. When required at the mill for sawing, the logs are reloaded by the derrick. It has been found that the derrick not only speeds up the two operations but also saves money by reduced handling costs. Fig. 10 shows wooden derricks working on the construction of foundations for the Bronx Terminal Market in New York City. In the large cities the common labor shortage for heavy jobs is felt even more than in some industrial centers and for this reason contractors are investigating all types of materials handling equipment. The use of derricks equipped with excavating buckets permitted this contractor to proceed with the work, and to quickly load the motor trucks, without the need of worrying each day about his common labor force.

Derricks mounted on a traveling gantry crane structure, as shown in Fig. 28, can be used on many operations other than the handling of ships' cargo, but they have also been found very efficient for this purpose. In order to serve ships on both sides of the dock, a derrick is mounted on alternate corners. These machines are electrically operated and are self-propelling, obtaining their power by means of a shoe and third rail.

Gantry cranes are to a degree an adaptation of the overhead traveling crane to outdoor service where there is no permanent elevated structure on which to install a crane. Different designs of gantry cranes are shown in Figs. 4, 17, 21, 31 and 32. The majority of installations of this type of crane are known as traveling gantrys, but frequently the traveling feature is not required and stationary gantrys are installed.

The hand-operated stationary gantry cranes as shown in Fig. 4 are especially adapted to railroad service, or

(*Continued on page 69*)



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MANY exclusive features of design and construction make Medart Steel Shelving adaptable to any use. The photograph illustrates the wide variety of materials which can be neatly and compactly stored. Medart Steel Shelving is simplicity itself—easily assembled or rearranged—attractive in appearance—carries great weights—gives long service. Cost reasonable. Write for catalog "S-7."



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CEMENT BLOCK	GABLE BOTTOM	PIG IRON
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Complete Industrial Railway Equipment

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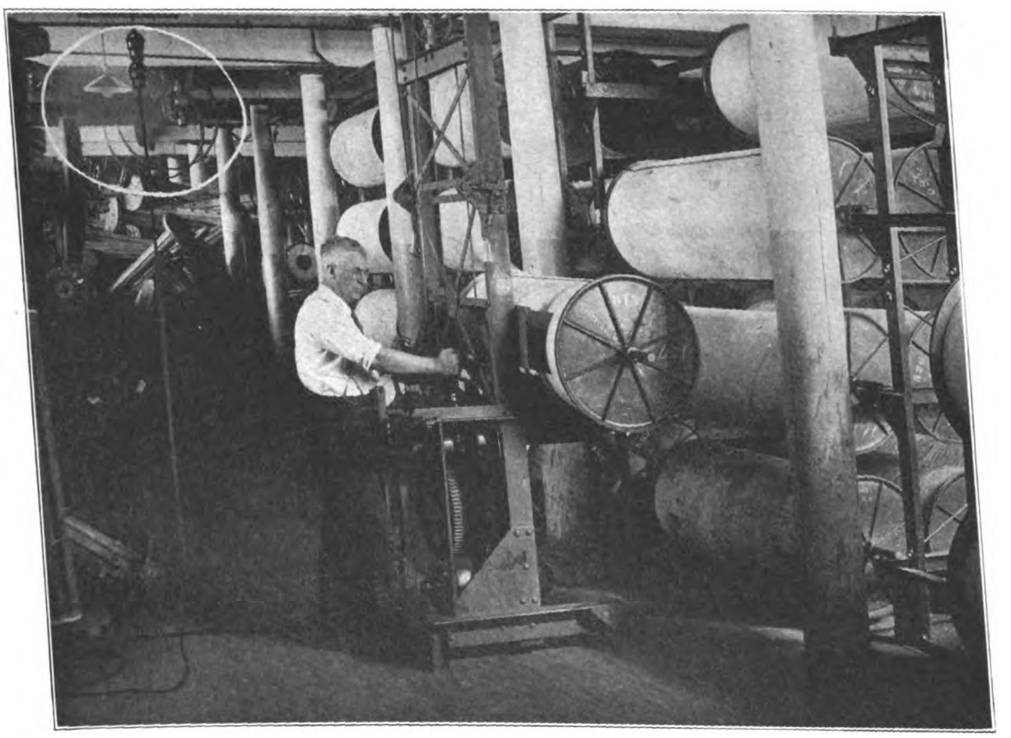
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FOR EVERY INDUSTRIAL PURPOSE

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Lifting Power—Use It



You can run a Little Lifter from any ordinary light socket

THE Little Lifter is a high grade portable elevator equipped with a small motor so that it can be operated from any light socket.

Just think what this means to you. Here is a machine that can be taken into any part of the plant, the extension plugged into a convenient drop cord and any lifting job accomplished in jig time. No laborious cranking; just throw in the clutch and up she goes.

The picture shows a Little Lifter elevating a warp beam for storage in the top tier of the racks, which we also built. These beams are really big spools of yarn, very carefully wound and familiar to every textile man. They usually lie around on the floor awaiting call from the weave shed.

Order, cleanliness and a big saving of space are obtained at an operating expense no more than that of a few incandescent lights. This is merely one of the many odd lifting jobs that these machines will be found to fit into if you will always think of them as *lifters*, not just "stackers."

Economy Engineering Company

2663 West Van Buren Street, Chicago, Ill.

We have a representative near you. New York Office: 342 Madison Ave.

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(*Continued from page 66*)

in industrial works where the volume of heavy objects to be handled is not great and would not warrant the expense of electric equipment. The simplicity of operation and the low cost of maintenance make a crane of this type an economical machine for such service. An electrically operated stationary or traveling gantry crane similar to that shown in Fig. 17 should be installed when constant service is required or where the weight of the objects to be handled is beyond the capacity of a hand-operated machine. A crane of this type installed over one or more railroad tracks and equipped with a hoisting hook or with a sling is especially useful in loading or unloading heavy freight. It may also be equipped with a magnet, or for bucket operation and used to handle coal or similar materials when only a transverse movement is required. Under these conditions it is as applicable to the industrial plant as it is to the railroad yard.

Traveling gantry cranes vary from light structures mounted on small wheels and hand-operated to numerous designs of electrically-operated structures equipped with one or more crane trolleys and carried on trucks of substantial construction. These cranes are built with spans upward to 200 feet or more and are used in storage yards and at docks for handling ore, coal, coke, cement or manufactured materials; in railroad storage and transfer yards, for general purposes and for transferring heavy freight; and at wharves for handling cargo.

In traveling gantry cranes the bridge is fixed on trestles having legs which are generally mounted on trucks similar to those used on traveling overhead cranes. To meet special operating conditions, they are sometimes constructed as shown in Fig. 21, with one gantry leg—the other end being supported by other means, and also are frequently equipped with the movable cantilever at one end. The reason for equipping this particular crane with the movable cantilever was to permit it to unload cars on the second railroad track and yet be able to pass the gas holder so that it could travel the full length of the storage yard.

Fig. 31 illustrates the possibilities of traveling gantry crane construction. This crane has a movable cantilever at one end and a stationary cantilever at the other and is built with two types of gantry legs one of which is equipped with a special hopper and weighing device for loading materials to motor trucks.

Fig. 32 shows the type of bridge gantry cranes which are now being used by steel mills and related industries for handling their bulk materials. This is only a part of the equipment used by the Donner Steel Co., at Buffalo, N. Y., for handling their raw materials from ships to storage pile and from pile to plant. The cranes are equipped with large capacity buckets and handle many thousands of tons of materials per year. This type of equipment makes possible the handling of a volume of materials that would not be possible by old hand methods.

While cranes of standard or special construction have been described they have not dealt with special operations, or has it yet been pointed out where one or two cranes can eliminate the use of many derricks, cranes and hoists. In the illustration, Fig. 29, however, we see the Isthmian Steamship Lines, ship "Steelvendor," which is equipped with two special revolving, electrically-driven cargo unloading cranes which are a part of the ship's

(*Continued on page 71*)

STROM BALL BEARINGS

What this trade-mark on a Ball Bearing means to you—

A STROM trade-mark on a ball-bearing means that

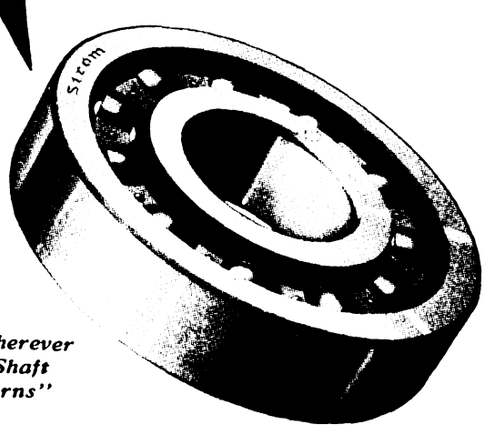
—You are getting a bearing which is the first choice of leading engineers in all industries.

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—You are getting a bearing made of special ball bearing steel, heat-treated by the most modern and approved methods (not merely case-hardened).

—You are getting a bearing which is made by skilled workmen in a modern plant and rigidly inspected in every step of its manufacture.

—You have at your disposal—always—all the resources of this great institution devoted solely to manufacturing high-grade ball bearings.



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HAVE YOU a Lift Truck IN YOUR BUSINESS?

Let me just take time to tell you 15 reasons why over 5000 users believe JACKLIFT is "The Master Elevating Truck."

—A. L. Lewis—*President*

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13. Over 40% of our business is in repeat orders
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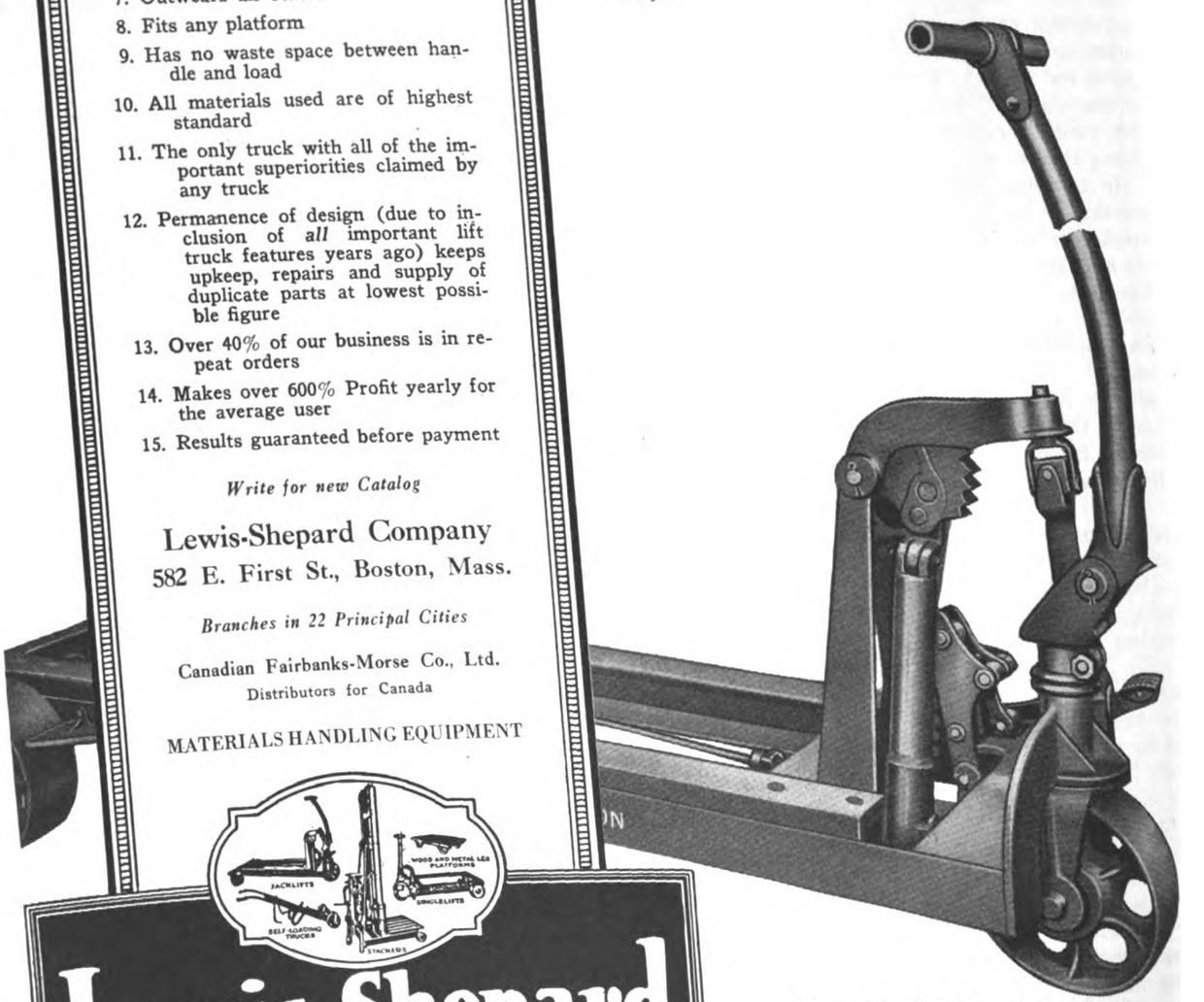
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Rugged Lewis-Shepard steel leg, lift truck platforms. All sizes for all purposes. Live longer because they're built stronger.

Our new Catalog demonstrates the use of Lewis-Shepard Materials Handling Equipment in 32 Major lines of Business. We have detailed data on 150 other lines. Write us today.



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The Jack is the oldest and most reliable means of lifting loads easily. When it comes to Labor-Saving by efficient handling and transportation of materials get acquainted with JACKLIFT —"The Master Elevating Truck"

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(Continued from page 69)

equipment. These cranes, because of their long booms and revolving feature, can operate much quicker on the loading and unloading operation than the ordinary ship derricks and slings. In addition they centralize the unloading control to two distinct points and do away with a large number of derricks, tackle and hoisting engines.

The revolving cantilever crane mounted on a tower as shown in Fig. 30 has a number of advantages, the main one of which is its ability to be stationary and yet serve a very large area. The stationary feature makes for lower maintenance cost, replacing worn out moving parts. This crane is equipped with two large capacity buckets and is handling clinker at the plant of the Riverside Portland Cement Co., Riverside, Cal.

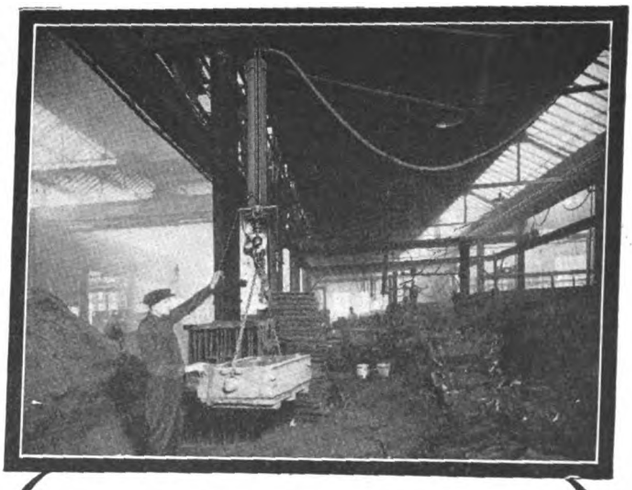
It is not customary to call a hoist a crane and yet they are frequently used in place of cranes. For this reason we show as a comparison to Fig. 26 the hoist handling a 300-ton locomotive in Fig. 25. Shop construction might be such that it would be impossible to install a crane and then in order to raise the load a hoist would serve the purpose. It is true the hoist cannot travel in a longitudinal or traverse direction, but it can lift the load.

Many plant executives are so used to seeing cranes that they do not realize their true value or are they investigating their present installations to see if they are being overloaded. Many cranes are now showing a high maintenance cost because they are performing too much work. Many crane bays which are now equipped with one crane should be equipped with two or more cranes in order to properly handle the work. In other instances the crane was installed to handle maximum loads of 5 tons, but as production increased it was found necessary to overload the crane in order to handle the required materials within the working day. This practice of overloading cranes is dangerous and should not be practiced.

It will pay plant executives to look over their present crane equipment and see if it is properly used or abused. Cranes, as in the case with other materials handling equipment, are considered as everlasting and not requiring proper upkeep. This lack of the proper knowledge of cranes, their uses, and the need of constant supervision is the cause of most breakdowns and delays. If the executive will look at each delay and each breakdown in the light of lost dollars and cents, lost production time, inconvenience and demoralization of plant working schedule, he will quickly see the need of properly caring for the crane equipment.

The many types of cranes here mentioned have many points of application in practically every industry and the savings that can be effected on any one operation depends largely on selecting the right type for the job and then properly maintaining it.

Recommendations that 526 types of forged tools be reduced to 364, through the elimination of unnecessary types and sizes, were being considered at a conference under the auspices of the Division of Simplified Practice of the Department of Commerce. The recommendations, adopted by the Forged Tool Society representing approximately 90 per cent. of the forged tool manufacturing capacity of the United States, affect the tools of railroad construction workers, miners, road builders, builders, lumbermen, masons, blacksmiths and farmers.



Do You Lose Money *Between* Machining Operations?

EVEN if your plant is equipped with the most modern production machinery, there is still a big chance for you to lose money *between* machining operations?....Why? Simply because you may not be *moving* your material with dispatch, or economy (i. e. low labor cost).



Curtis All-steel *Air* Hoists and Roller-bearing Trolleys lift and move any kind of material, quickly, economically and safely, making use of a power already available in most plants. They save time and energy and men—before, during and after machining operations. With Curtis I-Beam Trolleys a 4000-lb. load can be moved by a 50-lb. pull.

Capacities up to 20,000 lbs. and various types to meet your particular needs. Send for full information.

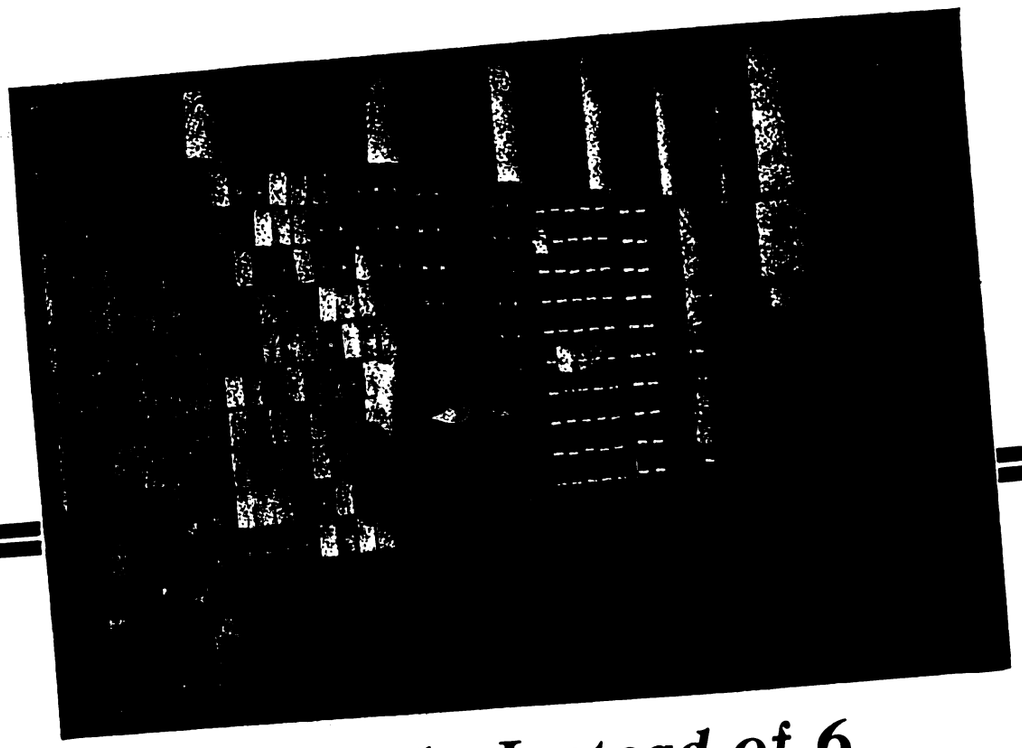
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"Lift it With Air"

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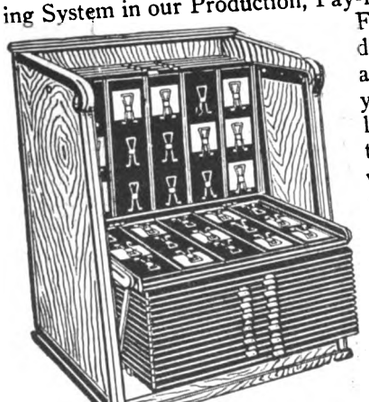
2 Clerks Instead of 6

A McCaskey Cut $4,000 a Year from One Payroll

WOULD it increase your profits if 2 clerks could do the work of 6 handling your job tickets, production records, payroll figures, stock requisitions, and the like? Would you like to save $4,000 a year in salaries for such work?

One firm, the Kellogg Manufacturing Company of Rochester, N. Y., has been doing this for 4 years. Read what Mr. Wm. R. Glavin, their production manager, has to say about it:

"We have been using the McCaskey One Writing System in our Production, Pay-roll, Rough and Finished Stock departments, for approximately 4 years with excellent results. At the present time we are extending this system to cover our foundry. Altogether 15 double registers and approximately 100 production boards are used in the work.



Standard System Eliminates Errors

"With the McCaskey system all departments are tied up on a standard basis, our information in each department is identical and up-to-date. Costly errors are a thing of the past. We have a running inventory of our work in process by Parts and Operations right before our eyes which we get by simply filing a copy of our job tickets. Another copy of the job ticket handles cost, and still another, payroll. Our production information has been brought visibly abreast of progress, an advantage which we never before enjoyed.

Cuts Payroll $4,000—Records Kept Up-to-date

"We previously used the Card and Ledger systems for this work, but with six clerks we were not able to do the work we now accomplish with two. Our records were seldom up-to-date and we were working very much in the dark. Our saving in a salary way amounts to at least $4,000 a year; production has been materially increased; and our stores burden has been greatly reduced—at the same time being kept in better order. Because of these reasons we cannot recommend too highly the McCaskey One Writing System.

"We use the McCaskey (Carbon Back) forms throughout our entire plant and find them the most satisfactory as well as the cheapest forms we ever used."

Can You Cut Your Overhead?

McCaskey systems are in hundreds of different types of plants. They have many different uses. They are keeping a perpetual inventory, checking tool losses, delivery control, costs, production control.

In short, they can be adapted to any job where detail records are kept. They result in better satisfied customers, faster work and less confusion than the old card and ledger way. We would be glad to show you how a McCaskey system can be used in your plant—Write us.

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Pioneers of Power

(*Continued from page* 18)

inate the condensation of live steam in the engine cylinder with the resultant loss of possible work. He recognized that the alternate heating and cooling of each cylinder end by the live and exhaust steam was the cause of this condensation. In his uniflow engine he prevented this loss by making the steam flow in one direction only. Steam enters at each end alternately and exhausts at the midpoint of the cylinder barrel.

Although Prof. Stumpf's experiments were conducted abroad, the success and practical value of his invention were at once appreciated throughout the engineering world and we have today in this country an increasing number of engines of the uniflow type.

But the development and perfection of the reciprocating steam engine has been but one phase of the progress in the steam engineering world. Equally important strides, with even more far-reaching results, have been made in rotary prime movers, or steam turbines, as we familiarly know them.

Roughly speaking the entire development of the steam turbine has taken place within the past fifty years, in spite of the fact that Hero described his reaction turbine more than twenty centuries ago.

In the steam turbine, rotation is produced and power developed by directing steam at high velocity into single or successive rows of blades, which are mounted on the circumference of a revolving drum. The kinetic energy of the mass of steam is imparted to the turbine rotor in this way.

When the motion is produced by the "kick" or reaction of the steam jet as it leaves the blades, the turbine is a reaction turbine. When the impact of the jet upon the blades produces rotation the turbine is an impulse unit. These are the two fundamental types of turbines.

In the development of the reaction turbine Sir Charles A. Parsons was the leading exponent and creative genius. He found many difficulties to be overcome and expended a considerable personal fortune in pursuing this work.

Backed by the unfaltering courage of his convictions, he began in 1884, facing his first problem, namely, that of determining whether mechanically constructed bodies could be operated at such high speeds as 18,000 to 20,000 revolutions per minute without flying apart.

Having mastered his initial problem, he proceeded to the building of a small turbine. In his early work he was associated with a firm of engineers whose principal business was the building of small units for operating lighting sets on shipboard.

He realized, however, that the sphere of the steam turbine was in the larger sizes. Accordingly he later established his own engineering works for the purpose of building steam turbines and applying them to what he believed was their proper use, *viz.*, central station work.

In this work his progress was materially retarded because of the fact that there was small demand for high speed machinery, and high speed electric generators were then built only in the smaller sizes. Gradually, however, as the economical possibilities of large high speed units became apparent the opportunity for the steam turbine grew and his field widened.

Sir Charles Parsons was unrelaxing in his energy in the development of the reaction turbine, his efforts cul-

(*Continued on page* 76)



Smoke

no longer the sign of enterprise

THE cloud of dense smoke that streamed across the top of almost every old-time letterhead was once the pride of thousands of manufacturers—the great symbol of industrial activity.

Then came scientific combustion and public opinion opposing the smoke nuisance. Smoke became the sign of waste and the evidence of law breaking. The "Enterprise" Manufacturing Company joined the hundreds of other concerns that were being forced to change their letterheads—and their ways.

The great wave of public sentiment for smoke abatement proved to be one of the greatest boons to progress that ever swept the industrial world.

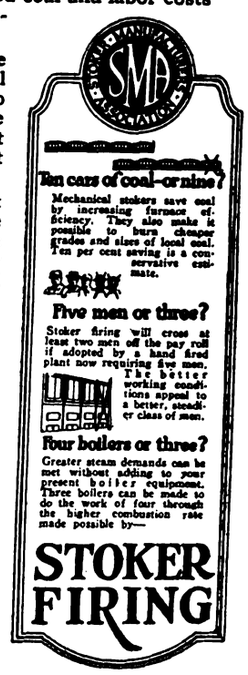
It forced industry to a keen interest in scientific combustion.

Power plant owners who sought only a smokeless stack and public good-will, found that along with smokeless operation went reduced coal and labor costs and greatly increased plant capacity.

They found, also, that the Manufacturers of mechanical stokers had gone intensively into the smoke problem long before the general public had taken it up, and had definitely solved it with *complete combustion.*

All good authorities agree that mechanical stoking is the one certain method of producing the complete combustion necessary for smokeless operation. And the economies of mechanical stoking are so great that the elimination of smoke—although often of first importance—is simply an incidental result!

Many enterprising manufacturers have eliminated the smoke decoration from their letterheads. There are still hundreds, however, that have not eliminated it from their furnaces and stacks who could do so by installing mechanical stokers. The owners, executives and directors of these plants will find a highly informative and timely message in the booklet, "Coal—The Basic Fuel." Have you read it? A copy will be sent you free on request to The Secretary of the Association.



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G. A. Sacchi, Secretary, Lester Branch, Philadelphia

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The Significance of C-H Control in Industrial Production

Present day large productions are to a great extent the result of motorizing industry. In this work control equipment developed by Cutler-Hammer engineers has made possible the greatest adaptability, flexibility and efficiency —in fact some motor-drive applications were made possible only through the pioneering work of the C-H engineering department.

For examples of this—witness the travel of the unattended ingot buggy in the steel mill far away from the pulpit where the operator sits with his battery of push buttons. Or marvel at the cycle of operations of the skip hoist;—the precise control of the mammoth newspaper presses;—the accuracy of the forward and reverse movements of the planer;—the human-like manner of carrying over the hard spots in lathe drive with subsequent speeding up when normal cutting is again possible; the functioning of the automatic refrigerating machine;—or even so simple a performance as the C-H Control for sump pumps that automatically takes care of rising water.

These are but a few thousands of jobs where C-H Control makes the muscle of the motor do its bidding—putting this power to useful work.

When considering motor-driven equipment take advantage of Cutler-Hammer experience in motor control. With your drive characteristics known, you can get a C-H Controller that will best insure the maximum results.

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Motor Control Department

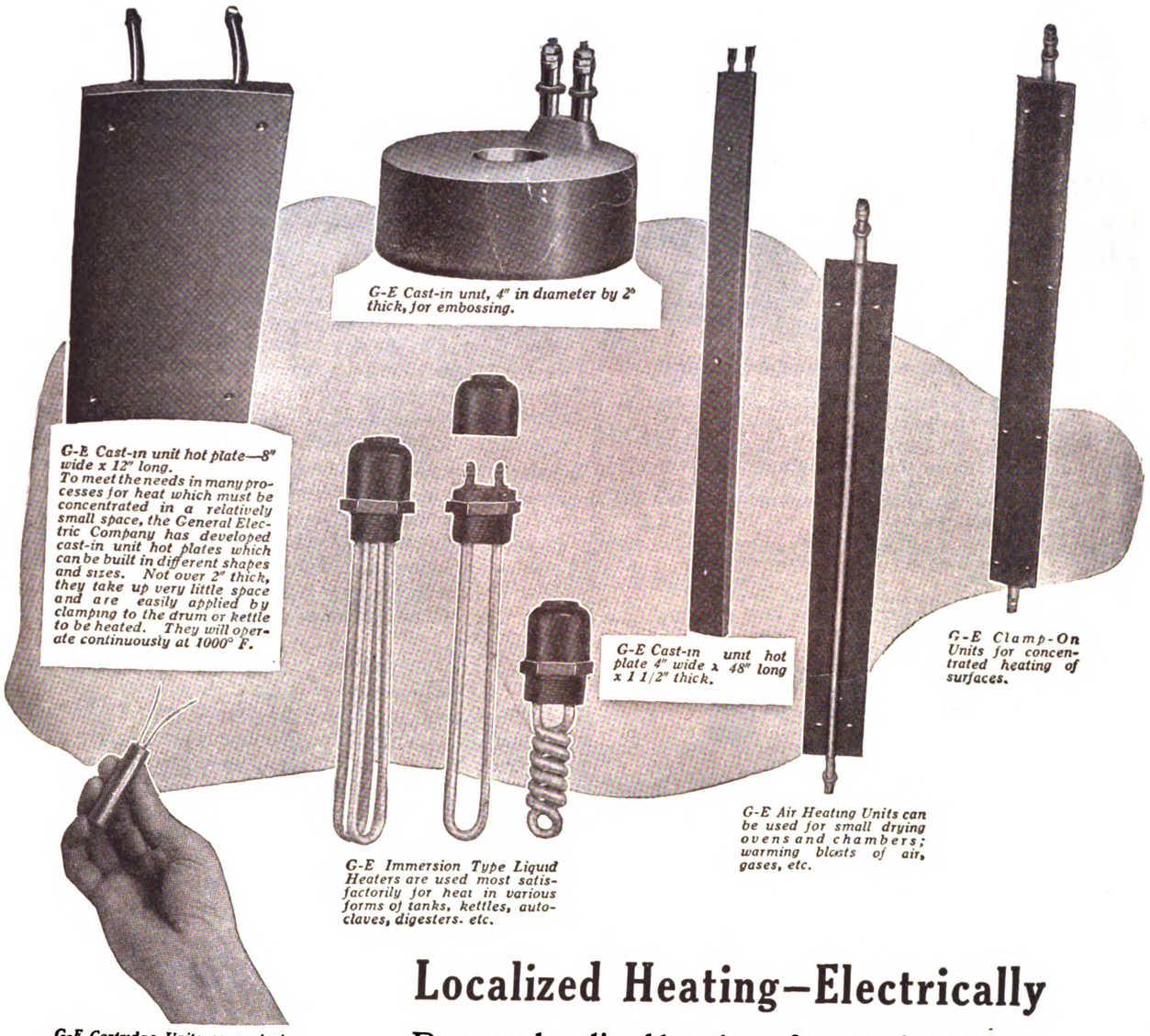
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G-E Cast-in unit hot plate—8" wide x 12" long. To meet the needs in many processes for heat which must be concentrated in a relatively small space, the General Electric Company has developed cast-in unit hot plates which can be built in different shapes and sizes. Not over 2" thick, they take up very little space and are easily applied by clamping to the drum or kettle to be heated. They will operate continuously at 1000° F.

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Localized Heating—Electrically

Because localized heating of parts of machines and products in industrial heating processes is so essential, the General Electric Company builds a variety of small Localized Heating Units which properly meet requirements of this character.

The General Electric Company is the originator of "Helicoil" Sheath Wire which has made possible the development of these Units.

G-E Industrial Heating Specialists will gladly make recommendations covering the installations of these Units for many heating processes in your plant.

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(*Continued from page 73*)

minating finally in the construction of enormous turbines for direct connection to the propellors of express steamers in marine service.

The impulse turbine made its debut in the seventeenth century in the form of a mechanical toy known as the Branca turbine. This consisted merely of a jet of steam striking the blades of a paddle wheel, which was mounted so that it could revolve. The idea existed merely as an idea and no practical use was made of it until recent years.

The impulse turbine and its possibilities attracted the attention of Charles Gordon Curtis while he was pursuing his studies at Columbia University. His energies were directed to the development of this type of prime mover in this country, while Sir Charles Parsons was perfecting the reaction turbine across the water.

With the development of an efficient prime mover, the perfection in design and increase in capacity of steam boilers has gone hand in hand. Within recent years there has been a reaching out for higher pressures and greater superheats, until it is difficult to say just what our next practical step will be. Perhaps, when certain difficulties that now seem unsurmountable have been overcome, we shall enter upon this now more or less unexplored region. The day of the "super-pressure" plant appears to be ahead of us.

With this striving for higher capacities we have also seen the attainment of higher economies. William LeRoy Emmet, consulting engineer of one of our largest industrial concerns in this country, is the inventor of the mercury boiler, a radical departure from previous boiler practise. Results obtained from his experimental installation at the Hartford Electric Light Company indicate a possible fuel saving of almost 50 per cent.

The same genius which Mr. Emmet has previously displayed in the improvement of the Curtis turbine and in other phases of power development has marked his efforts in this latest achievement.

Mr. Emmet has had many difficulties to overcome. During his early experiments it was found that no form of packing or calking of joints would resist the mercury vapor. It was necessary, therefore, to weld every joint in the apparatus. It was also necessary to devise methods of operation, as there was naturally no precedent to follow. The properties and characteristics of mercury vapor had to be studied with a view to developing accurate data.

It is early at the present time to say that all the operating difficulties have been overcome. Mr. Emmet has been working on this latest achievement for the past eleven years. If continued experiments confirm the apparent commercial value, we shall eventually enter upon another new era in the generation of steam and the development of steam power.

Some of the subjects to be discussed at the Spring Meeting of The American Society of Mechanical Engineers, to be held in Cleveland May 26-29, 1924, are—Power Problems in the Steel Industry, Interchangeable Manufacture, Windmill and Fan Design, and Materials Handling in Industry. Joint sessions will be held with both the American Society for Testing Materials and the American Society of Refrigerating Engineers.

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THE best industrial trailer is the one whose design and construction best fit it for the loads, speeds, pulls and shocks to which it is subjected. An ordinary truck — even the so-called "heavy" or "reinforced" type—is wholly inadequate. The Mercury Type A-310 is not only built specially for trailer service, but it embodies all the features proven best by experience. For over 9 years, the company behind this trailer has manufactured nothing but industrial tractors and trailers.

Six Reasons Why the Mercury Type A-310 is a Good Industrial Trailer

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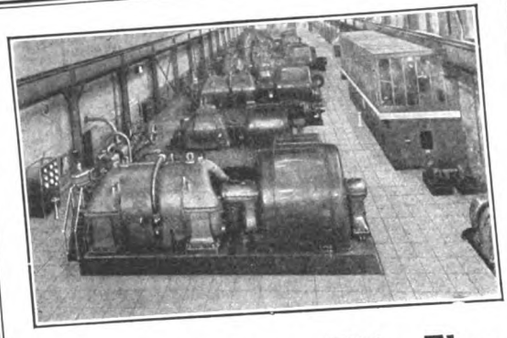
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Repaint your Plant the "SPRACO" Way



You Can't Beat This Floor

The illustration shows a Marbleloid Floor installation at the Brunots Island Station, Duquesne Light Co., Pittsburgh, Pa.

MARBLELOID
The Universal FLOORING for Modern Buildings

is a perfect industrial plant floor for every room from office to laboratory. It is a fireproof, composition material, very strong, exceptionally durable, non-abrasive, vibration-resisting and non-dusting. Attractively colored, warm, resilient, non-slipping and easily cleaned.

Write for literature—or use coupon

THE MARBLELOID COMPANY
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Putting the Sun on the Payroll

(*Continued from page* 23)

After the general structural design is established the next matter to have attention is the windows, including their arrangement, construction and the type of glass.

Windows should extend from the working plane to the ceiling or as near to the ceiling as possible, not only for maximum illuminating effectiveness but also for ventilation. There is no value in carrying the glass below bench-height. The wall space is generally needed for radiators, benches, conveyors or other equipment. Since much heat is lost through glass it is also economy to use a solid wall to the floor. Machinery should be placed correctly with respect to the windows, lest the operatives be forced to work in their own shadows.

The choice of window sash and frame depends on a number of conditions. If maximum light is to be obtained through a given aperture in the wall, it is well to use sash with narrow frames, mullions and meeting rails. Otherwise the choice is governed by considerations of cost, durability, ventilation, appearance and method of cleaning.

Of the various types of sash on the market, "factory" or rolled steel sash is probably the commonest. It can be used for large openings and can be set in long continuous rows. The members are small and offer little obstruction to light. Openings for ventilation can be provided, which by the way, should be placed at the extreme top and bottom sections if thorough ventilation is desired. Center openings only are of comparatively little value. Continuous sash comes in standard sizes and units, with pivoted or projecting sections for ventilating.

There are various types of sliding sash, the most common being double hung windows similar to ordinary house windows, in which the upper and lower sash move independently of each other, being counterbalanced with weights. In another type the upper and lower sash are balanced one by the other, so that when one goes up the other goes down and vice versa. Both types of sliding sash require rather heavy mullions and meeting rails.

Where thorough ventilation is essential some one of several types having a combined sliding and pivoting or projecting action may be used. They are generally operated by a simple system of levers so that openings occur at the top, center, and bottom of the window simultaneously, and the glass projects at an angle to the frame in such manner as to prevent rain from driving into the room.

Rolled steel sections are used for low cost work and general factory purposes, while bent steel shapes or bronze are employed for higher grade work such as for office buildings.

Next in importance, and in some ways the most important item of all is the kind of glass used. A clear or transparent glass transmits light most efficiently, yet often a translucent but not transparent glass is to be preferred. Of the transparent glasses, there is choice between ordinary window glass of single or double thickness and polished plate wire glass. Clear glass should be used in windows up to and a foot or so above eye level even if a diffusing glass is desired in the rest of the windows. Manufacturers find that their operatives are more contented when they can look out doors on occasion, due partly to the fact that it is resting to the eyes to get a

(*Continued on page* 81)

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Spread the Sunshine Inside



Entire plant FLINT MOTOR COMPANY (Star-Durant), Flint, Michigan, day-lighted with Truscon Industrial White.

With TRUSCON INDUSTRIAL WHITE

You can have bright interiors at moderate cost without using the unsatisfactory cold water paints which flake off, soil easily and are expensive because of their short life. You can now get TRUSCON INDUSTRIAL WHITE at an exceptionally reasonable price. It is an oil paint of unusual light-reflecting value and made especially for industrial use. It retains its beautiful whiteness and does not discolor. It is durable, in fact you can wash it if you care to.

Truscon Industrial White is furnished with a gloss or eggshell finish. It is applied by brush or spray and is used on plaster, concrete, wood or metal.

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OVER a year ago a meat packer—serving only one state—became interested in Pioneer Wire-bound Boxes. A trial order was placed for one carload. For the past year all their products have been shipped in Pioneers—ranging up to 300 pounds capacity.

Formerly this company bought shooks and assembled their own boxes.

The total savings made in 1923 due to the use of Pioneer Boxes amounted to $9,048.00.

The initial cost was somewhat lower on Pioneers. The box weight was reduced nearly one-half. The cost of assembling boxes was reduced eighty per cent.

These three items saved $9,048.00. In addition, the Pioneers are loaded with 5% more merchandise. They withstand cold storage without weakening. Save cooler and freezer space. Are stronger than ordinary nailed boxes.

This is an instance of the great savings made by a manufacturer serving only one state. Those manufacturers who serve a wide territory will find far greater savings.



Our Engineers will be glad to design a Pioneer box or crate for your individual needs and tell you exactly how much you can save. It will cost you nothing to find out. A post card will have our immediate attention.

Write for "General Box Service"—a booklet of information on better boxing and crating methods.

GENERAL BOX COMPANY

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SIXTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

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(*Continued from page 78*)

distant view from time to time. Furthermore certain types of rippled or prism glass produce an intense glare which is most discomforting if placed at eye-level.

Wire glass, often required for fire protection or where there would be danger from shattered glass, comes only in the "polished plate" grade which is transparent, and in the ordinary "rough" grade which is translucent. The latter is much less expensive than the former and has the advantage of diffusing and distributing the light in an effective manner.

Daylight entering a transparent window largely falls at an angle, penetrating but a relatively short distance into the room. Much of the light is absorbed by the floor and machinery. To carry as much as possible of the light toward the center it is desirable to bend these oblique rays more or less horizontally, or else to have them strike the ceiling or other good reflecting surface which will spread them into the interior. Rough glass breaks up the rays of light, diffusing them in all directions so that some are deflected from the ceiling, others are cast horizontally into the room and the rest fall on the working plane near the windows. Enough of the light is spread in the right directions to make the use of a rough glass preferable to clear glass, especially in wide buildings.

More efficient results are obtained by the use of glass having prisms so arranged as to accurately bend the rays to a horizontal position. Such glass is highly effective but is too costly for general use. A less expensive substitute, and one practically as good is ribbed glass, which has semi-circular ribs of small radius rolled into one face. Theoretically these ribs should be placed horizontally, but in actual practise, to prevent their catching dust and dirt, the ribs are often set vertically.

Other types of translucent glass such as "ground," "frosted," "flowered," and "milky" are useful only for decorative or other special purposes as they do not transmit light as efficiently as ribbed and rough glass.

Corrugated wire glass is particularly useful in sawtooth skylights, for in the opinion of many engineers its great diffusing powers make it more effective than flat glass. It is also useful for skylights, monitors, marquises, and for roof lights in conjunction with corrugated metal and asbestos roofs.

Research has been carried on for years to find a glass that will admit light but not heat, for use in windows receiving the direct rays of the sun. Recently a "non-actinic" glass having a slight yellowish color has been placed on the market which, it is claimed, will not pass the ultra-violet and infra-red rays and thus keeps out the heat as well as the light elements that are harmful to some dyes, rubber, textile goods and other sensitive materials. There are also one or two kinds of transparent color stains to be applied to clear glass which are said to achieve this same purpose.

Special kinds of glass are prepared to meet unusual conditions. Roof tiles of glass can be had to closely match clay tiles to form an almost invisible skylight. Cement roof tiles are made with glass lights embedded in the centers which likewise may be used for a limited amount of light in the roof. The heavy prisms familiar as sidewalk lights for the illumination of basements and subways may also be set in concrete roofs. Some successful installations of this type have been made in railroad stations and train sheds.

(*Continued on page 83*)



"Factories and Industrial Plants welcome me. They know I'm dependable—Economically durable."

WITT CORRUGATED CANS AND PAILS

are constructed to withstand extra hard usage —heavy sheet steel, corrugated for extra rigidity and strength, protected at top and bottom by heavy iron bands.

Additional security is found in the snug fitting but easy lifting lids and the seams made watertight by a special process.

No matter what your Can or Pail requirement, there is a WITT of the Type and Size.

WITT Corrugated Cans and Pails are carried by the best dealers everywhere. Write us your requirements and for our Catalog.



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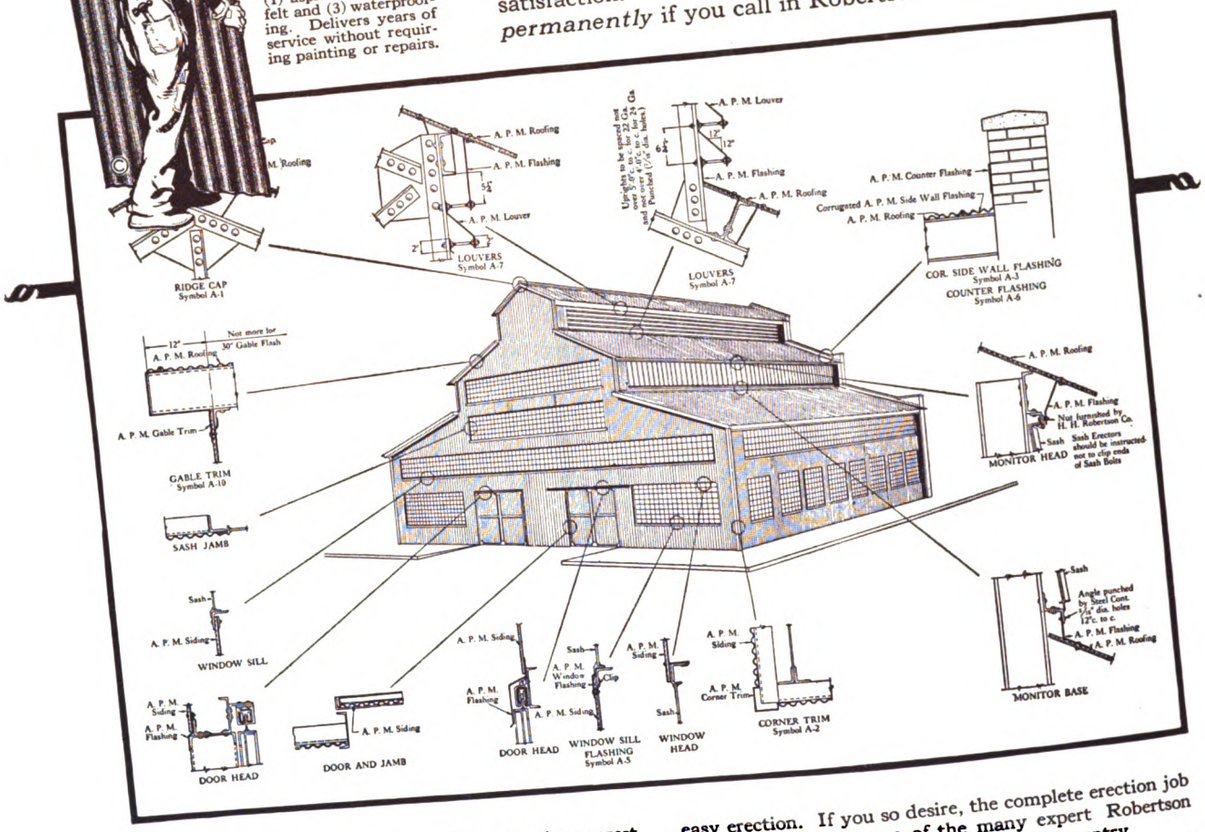


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Have you an urgent need for a new warehouse, an extension to your factory, perhaps several additional buildings? And must it be permanent construction—yet construction that is moderate in cost?

Robertson can solve your problem to your complete satisfaction. You can build quickly, economically and *permanently* if you call in Robertson men to help.



A PHONE CALL, a wire or a letter to the nearest Robertson Office puts you in immediate touch with a complete engineering service and a manufacturing organization whose combined efforts will enable you to erect a *permanent* building with unusual speed and economy.

Robertson Engineers will go over your building plans and draw cff specifications for a complete building covering of Robertson Process Asbestos Protected Metal (APM) —including roofing, side wall construction and every detail of building trim (as illustrated above).

The Robertson Factories will fabricate the materials and deliver them to your building site ready for quick and easy erection. If you so desire, the complete erection job can be handled by one of the many expert Robertson Field Crews operating in all parts of the country.

The enduring qualities of Asbestos Protected Metal as a building material are well known in every industrial field. There is no material of equal permanence which can be so easily, speedily and economically erected.

There is a Robertson representative near you. Put your problem up to him. To consult him puts you under no obligation to buy the service or the products he has to offer. Get in touch with him without delay.

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(*Continued from page* 81)

In winter the windows in many plants condense a great deal of moisture which not only may drip onto machines and goods below but which also reduces the translucency of the glass to some extent. Where high humidity occurs within the plant it may be necessary to use double glazed windows in which two panes of glass separated by a dead air space are set in each section of the sash. This effectively reduces the conductivity of the window and thereby eliminates condensation.

The most efficiently designed factory with great areas of windows to provide the maximum of light may yet fail to achieve its purpose if the glass is not kept clean. It costs money to get good natural light into a building, for large windows mean increased heat losses, yet often the advantages gained by the large windows are lost for the lack of occasional cleaning. If good lighting pays in higher productivity then the cost of window washing is money well spent.

Glass accumulates dirt with surprising rapidity and its translucency falls rapidly as the film becomes more dense. It is not uncommon to see foundries and machine shops with huge monitors and many square feet of glass so dark within from the grime on the windows that artificial light is needed by the workers even in day time. Washing should be done periodically and systematically. Pivoted sash may be cleaned from within the building. Sliding sash and other types which allow a man to climb outside can be cleaned by workmen standing on the sill. Provision for safety belts should always be made when such windows are installed. Large areas of fixed sash generally are cleaned two or three times a year by workmen on painters' scaffolds suspended from the roof. Windows in one story buildings may be cleaned with a hose from the ground.

The intense glare of direct sunlight often must be subdued for the sake of the workmen stationed near the sunny windows.

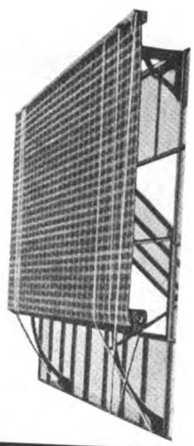
For a very cheap makeshift, whitewash is sometimes applied directly to the glass in summer, but it has the obvious disadvantages of being still there on cloudy days and in late afternoons. White cloth curtains of cotton duck or similar material that slide across the windows are frequently used but they are likely to blow about in the wind and constitute a serious fire and accident hazard. Roll shades of various types are available and they may be applied individually to the movable ventilating sections. When kept under tension they are reasonably satisfactory. Various modifications of venetian blinds are also used and some of them function successfully.

Now turning from windows and window appliances the last matter of importance is the interior finish of the building, with particular reference to the color and surface treatment of the walls, columns and ceilings. The high intensity of illumination at the windows must be carried as far into the building as possible by reflection from objects near the windows. A great difference in the interior lighting may be observed by using various colors on the walls and ceilings. White is by far the most efficient color for this purpose.

A habit of long standing that will doubtless eventually give way is the custom of painting all ironwork and machinery a dead black. In time it is reasonable to believe that much of our machinery will be finished in light grey or sand color with a corresponding improvement in the brightness and cheerfulness of our factories.

30 to 40%
More Light
More Air





RA-TOX Shades are made of selected bass-wood strips, woven parallel; attractive fast colors add smart business-like appearance. They will deliver 30 to 40 per cent. more light and air than any other type of shade into the shaded area. Constructed of wood fabric they are non-conductors of heat.
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RA-TOX
Offset Wood Fabric Shades
For STEEL SASH

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MILLIKEN BUILDINGS are formed of standard structural steel under a patented construction system. They are Complete — All-Steel — Permanent — Fireproof. They give the owner a specially designed building at the cost of an ordinary structure.

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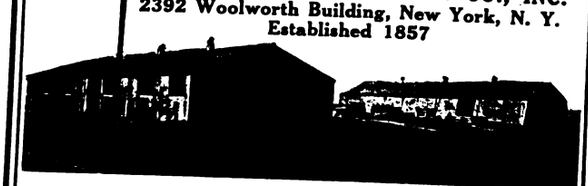
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of different types and sizes, with free, clear floor space and other features for effective industrial operation.

The material is stocked, ready for immediate shipment. Erection can be handled with local labor. There are no complicated parts or fittings. These buildings are ideal for light manufacturing plants, warehouses, storehouses, shops, and the like.

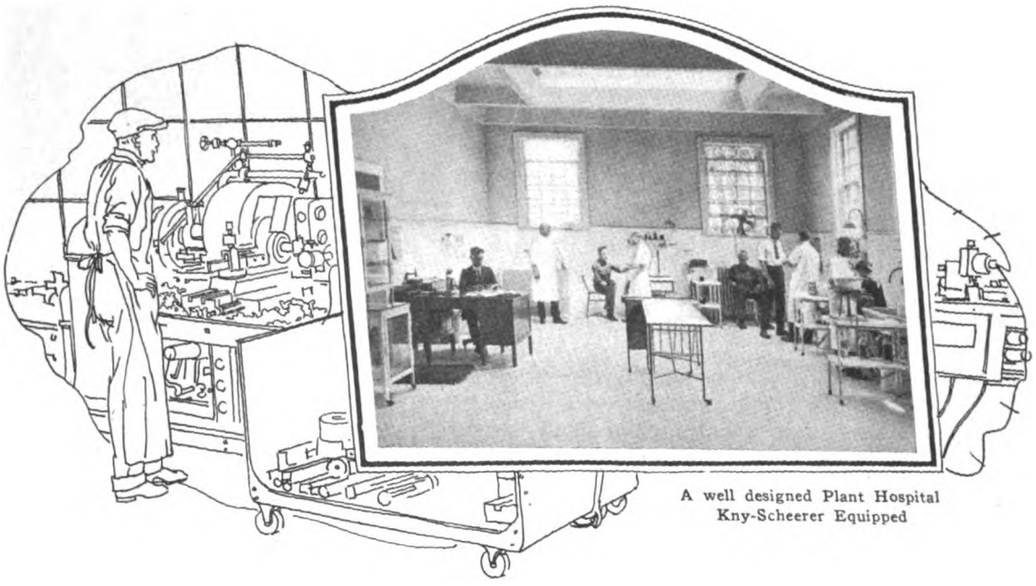
Send for Complete, Illustrated Catalog—it may solve your building problem instantly. Our engineering department is at your service—no obligation.

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2392 Woolworth Building, New York, N. Y.
Established 1857



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The Emergency Hospital Keeps Him at His Bench

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A plant emergency hospital not only helps to keep the machines and benches occupied, but it makes for increased efficiency and promotes employee loyalty. Physical examinations, quick treatment of common sicknesses, expert attention to small injuries, and first aid promptly given in serious accidents are items just as important as improved machinery and skilled workmen.

Your balance sheet will speak for itself.

The Kny-Scheerer Corporation, through its Engineering Department, can give you every assistance on installing or enlarging your plant hospital. Over a quarter of a century of experience in designing and equipping plant hospitals is placed at your disposal through this department.

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Keeping the Electrical Power Equipment Fit

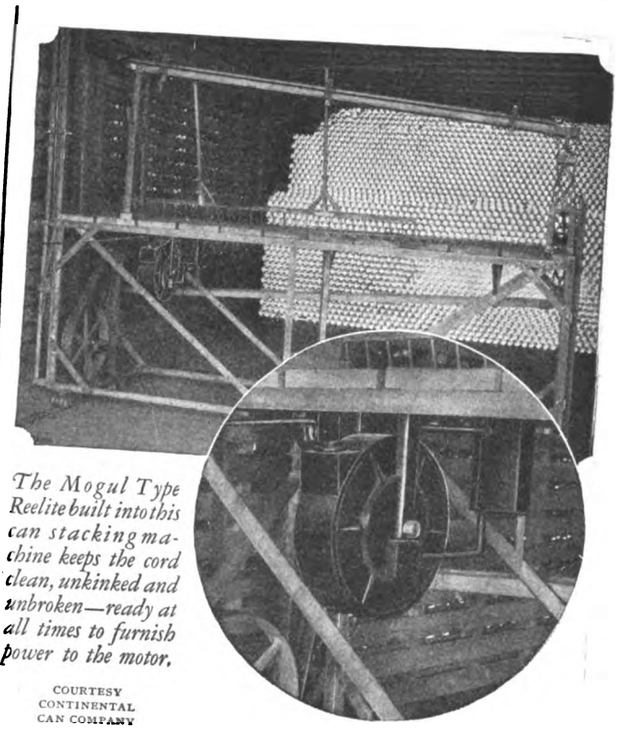
(*Continued from page 26*)

it cuts down the rating for the same operating temperature. Totally enclosed direct current motors may be used in these cases but squirrel cage induction motors are much better because they have no sliding contacts. With alternating current, squirrel cage induction motors are generally used for plant service. These motors are excellent for average plant line-shaft installations, but they should be kept at nearly full load in order to keep the power factor high. The tendency in most plants after the war was to leave motors in place as they were, and run only a portion of the machines, thus making a very low power factor and increasing power bills. If any such overmotored installations are still in place a thorough survey should be made of the entire plant with a view to rearranging motors so that they will be working at about normal loading. There are on the market motors that operate at unity power factor, and it is evident that on many installations they are extremely valuable. They naturally cost quite a little more than an induction motor but after a few years they are a paying investment.

If it is possible to have a number of motors alike, it is well to have a spare or two always ready to put in, in case of emergency. If complete spare motors cannot be held available some spare parts should be kept for all important motors. Plain bearing motors require more maintenance than ball bearing motors, as plain bearing should be oiled at least once a week. With ball bearings they can be packed with grease every three months in most cases.

A great many plants are gradually changing over to individual motor drives on each machine. This can be done in one department at a time, beginning with erecting shops and departments with a small number of heavy machines. This change is often advisable also when additional machines are to be installed in departments where the line shaft is already overloaded. The power saved by eliminating the friction of shafting, countershafts and belts is a big item and although individual drives are more expensive in first installation cost, they will pay for themselves in a few years by savings in friction and lower maintenance costs. Individual drives are especially good on machines that are operated at their full capacity but only at irregular intervals.

All plain bearing motors should be oiled regularly at least once a week, and every month or two the old oil should be drained out and the bearing washed out with kerosene. The rings in a ring oiled bearing should be perfectly free to rotate. At least once a week and usually at the same time as the bearings are oiled, the dust should be blown from the windings with an electric blower designed for that purpose, or with compressed air. In small plants a pair of bellows may be used. These are not so efficient as the motor driven blowers, but they should be used if the other methods are not available. All motors and electric equipment should be regularly inspected and reports made to the Plant Engineer's Office. One of the main points to inspect on induction motors is the clearance between the rotor and the stator at the bottom. The motor manufacturers can furnish these gap gages for each size of motor. When the bearings wear they allow the rotor to drop down, thus making the gap



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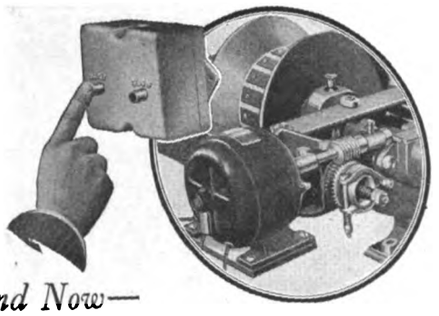
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at the bottom smaller; and as the bearings wear more and more the rotor drops until it touches the stator, causing a burnout. Inspectors' reports should be carefully studied and work orders made out for any jobs necessary to be done immediately and a tickler made to bring up jobs which may become urgent in a few months.

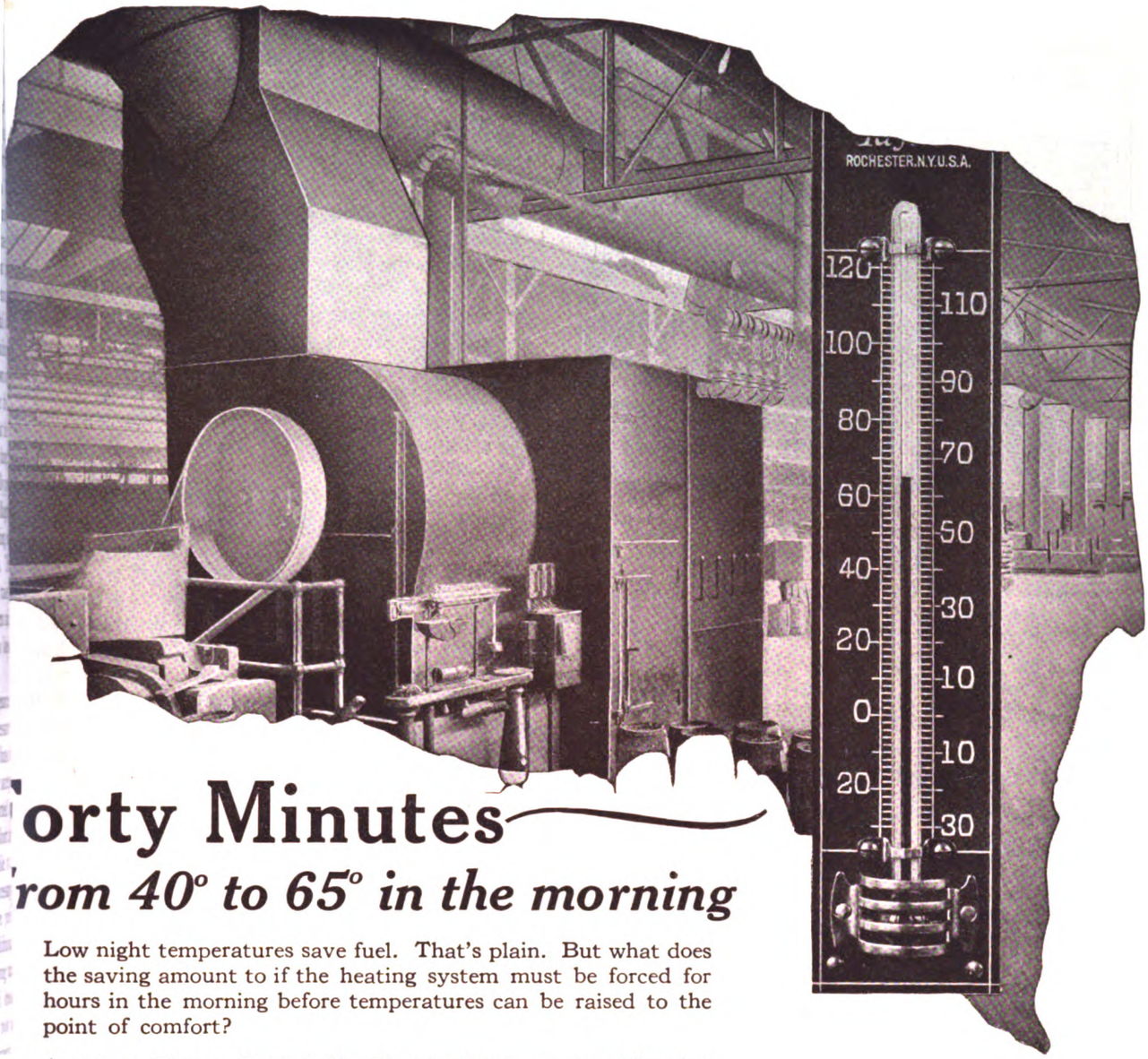
Elevator and crane motors are subjected to very severe service and it is quite important that they be inspected and kept in good condition. These services are exceptionally hard on starting panels, as the contacts are subjected to arcing in many cases. For all parts that are apt to burn out or wear out frequently, there should be a spare part in the maintenance department's stockroom. This is absolutely essential if repairs are to be made quickly, and a small expenditure for spare parts is really an investment in breakdown insurance. Where elevator machines are located over the elevator, an iron grating should be provided so that the men can walk all around the equipment without danger of falling. On large cranes a footwalk is usually provided so that it is possible to get at all vital parts. Magnetic brakes should be carefully maintained and lifting magnets should be in good order to avoid accidents. The feeder wires should be just tight enough to be raised off their supports when the crane moves past them and then allow them to drop back into place. If too loose they may get off their supports.

In the regular maintenance work in the plating department, it is often necessary to renew or reinforce the low voltage distribution buss bars from the plating generator to the tanks. The accepted method is to use heavy copper buss bars supported from the ceiling or walls. The runs should be as short as possible and in this connection it is often possible to rearrange old installations when additions are necessary. The direct connected motor-generator sets are preferable to the belt driven generators if new or additional equipment is necessary. It is best to have indicating meters and rheostats on each tank so that the rate of deposit may be regulated correctly. Many cases of poor plating could be improved if the plater had instruments to tell him what he was doing.

One of the frequent jobs in maintenance work is reinforcing existing power lines to take care of additional or heavier machinery. This can easily be done with open wiring but with conduit wiring it presents a problem. If new conduit is installed it is best to have it large enough to take extra wire in case of expansion. The labor of installing is about the same and the cost of using a size larger conduit is usually not excessive. Many parts of old plants still have exposed power wiring, and this should gradually be put into conduit especially if changes have to be made. Good materials in wire are especially important for low maintenance costs. This is especially true of insulation on wires in order to obtain the longest life possible in proportion to the cost. When sharp corners are necessary in conduit, fittings must be used, but where large swing bends are possible they should be used, as this method cuts down the cost by reducing the number of fittings necessary, and also allows longer stretches for pulling in the wire. When pull boxes are necessary they should be large enough to pull the wire through easily and have room for the spliced wires. Conduit work should be carefully inspected to see that the burrs are taken off the ends of the pipes so that

(*Continued on page* 88)

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(*Continued from page* 86)

the insulation will not be torn when the wire is pulled in. The locknuts and bushings should also be inspected to see that the threads are not so small that they barely hold.

All the motors in the plant should be periodically tested and a record kept which can be studied over a long period. This will be extremely valuable in finding troubles and correcting them before they get serious. The testing instruments may be indicating or recording; the latter being much better, as they record fluctuations that would not be caught by an engineer reading the log of an indicating meter. For this kind of test work the portable instruments are best. For complete tests, Ammeters, Voltmeters, Wattmeters, and power factor meters are used, but some may be omitted at the start. A glass test thermometer should also be inserted in the windings of the stator to check up the temperature rise under full load.

Where both A. C. and D. C. current are used, a wattmeter which will take care of both should be used. This is really the most important instrument and should be equipped to operate on all the voltages in use in the plant. In order to do this, current transformers are used when it is connected to alternating current circuits, and shunts are used on direct current circuits. Recording wattmeters do more than show what the motor is doing. Taken over a period of months they show whether the machines and shafting driven by that motor are getting in bad condition and using more power than they should.

It is a good idea to check the speeds of motors and line shafts under full load occasionally. This is easily done with a hand tachometer and will often show that, due to one reason or another, the lineshaft is not running up to speed. This cuts down production and should be remedied at once. Pulley sizes are usually figured from rated speeds without taking any slowing up factors, like belt slippage, into account.

Voltage regulation is a factor which affects very materially the speed and capacity of motors, and therefore induction voltage regulators are sometimes necessary to keep the voltage constant. When lighting and power are combined an unbalanced load is likely to result and voltage adjustments must take care of this in addition to load variations.

A great many plants are overmotored; which means, if they are using alternating current, that they have the problem of low power factor to contend with. With a low power factor the conductors have to carry a larger current than would be necessary with a unity power factor. This larger current heats up the conductors and reduces the carrying capacity of the line. Power factor can be improved in several ways. The first way is to rearrange motors so that each one carries nearly its full load, this automatically betters the power factor and at the same time increases efficiency. Another way is to use synchronous motors as condensers. The writer has used these motors on large air compressors, and on steady loads where the correction to be made is not great, they are often used. Another more recent way is to use static condensers. These do not require any attendance, which is often a point to be considered. If power is purchased the power factor often affects the bill, and if this is so it makes an additional reason for bettering it. It is often possible to find motors which

(*Continued on page* 90)

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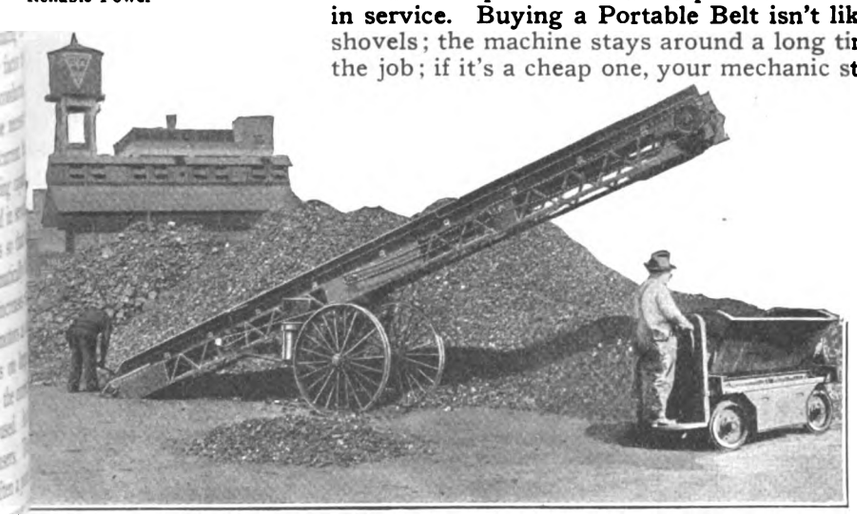
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(*Continued from page 88*)

are having a marked effect on the power factor, by means of power factor recorders, and when found and these places remedied, the whole system is much better.

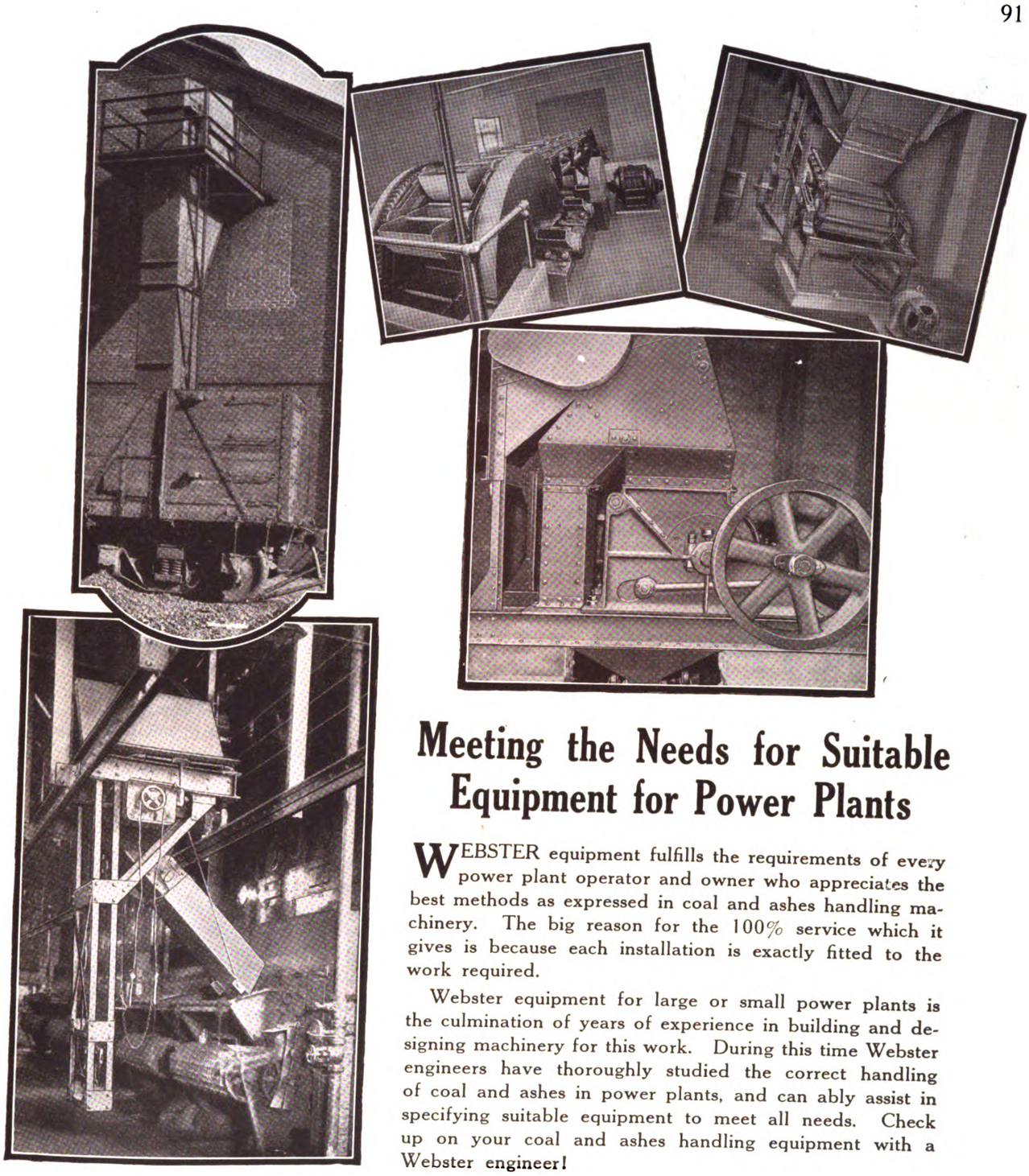
All motors should be properly equipped with controllers or starters to eliminate the danger of throwing a motor across the line. Indeed most codes prescribe that all but the smallest motors be protected. Direct current motors used in the average plant are usually compound wound motors. All D. C. motors should have starting rheostats or controllers so that the motor may be started slowly and not injured by excessive current. It is important that about thirty seconds be taken in starting, and one man in each department should be trained to start the motors correctly. A great deal of maintenance work can be avoided in this way. In stopping a D. C. motor the switch should be opened, allowing the arm on the rheostat to return to the starting position. For reversing duty the drum type controllers familiar to all those who ride in trolley cars are used. When automatic or remote control is desired, the automatic or self starter is used. These starters may be controlled in a variety of ways, probably the most frequent being by push button. If the distance to the point of control is very great there is a large saving in copper, which is of course partially offset by the higher cost of the automatic starter. Low-voltage protection should be afforded as well as no-voltage protection.

Auto transformer starters are quite commonly used on alternating current motors. They should be so arranged that the handle must be moved to the starting position first and, when the motor is up to speed, quickly moved to the running position. It should not be possible to operate in any but the correct manner. To stop the motor it is usual to trip the low voltage release. Time limit overload protection is often used instead of fused protection especially in cases where momentary overloads are apt to be present. For speed regulation with A. C. current, slip ring motors are used with a speed regulator, in addition to the switch or circuit breaker. Drum type controllers are generally used on reversing service. Automatic or self-starters may be used with squirrel cage motors when the starting torque required is not too great, and they are also used with slip ring motors on heavy duty service such as compressors, etc. All starters should have low voltage protection which provides that the motor will not start again when the power goes on after a shutdown due to voltage failure until the operator either starts the motor again in the case of manual control, or sets the master switch on an automatically controlled motor. A fused switch or a circuit breaker is necessary ahead of the starter, and it is now possible to use completely enclosed fused safety switches or enclosed circuit breakers. The latter will eliminate the need of switch and fuses and, with some designs, the overload relay from the compensator. For small A. C. motors the enclosed circuit breaker affords protection without the necessity of using a compensator.

The question of when to use circuit breakers instead of fuses must be decided in each individual case. However, as a general rule it should be said that any circuit which is electrically all right and yet keeps blowing fuses, should have the fuses replaced by a circuit breaker if for no other reason than to save time. Indeed, the time wasted in getting new fuses and putting them in

(*Continued on page 92*)

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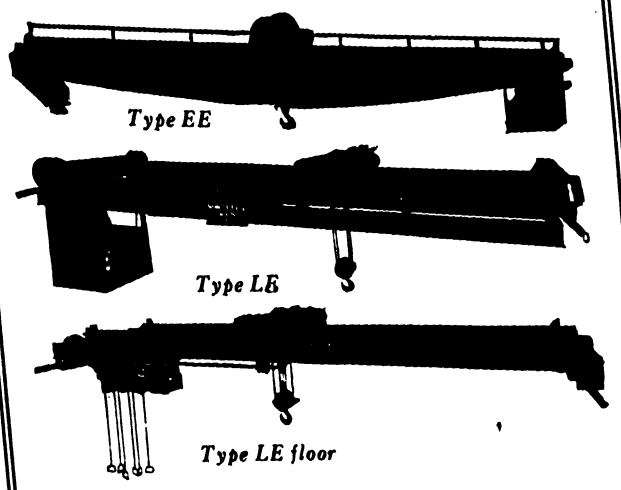
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(Continued from page 90)

often amounts to a good many dollars if all the expense is figured up. Of late years many renewable fuses have appeared on the market and in plants where the electricians have spare time, and therefore can reload fuses without additional expense, they are undoubtedly cheaper than one-time fuses. In a large plant a set of severe tests should be made of all available types before standardizing on any particular brand. They should be investigated from the standpoint of possibility of refilling with more than the rated amount of renewable fuse links, as this is sometimes done and is discovered after something happens.

Electrically heated furnaces have several distinct advantages over other types. For heat treating steel, scale is eliminated because the atmosphere in the furnace is neutral, it is easy to control the temperature, and a higher average quality should result. For annealing and other uses they are very evenly heated and are therefore well fitted for the service. Electrically heated ovens are widely used for japanning and various other uses. For all these uses the heating elements are subject to burnouts, and spares should be kept in stock at all times.

Various kinds of electric welding are often done in the same plant on different jobs. Arc welding is usually used on large seams or cracks either on maintenance work or on parts making up the product of the plant. Butt welding is often used to weld a small piece of high speed steel to carbon steel, as in the case of tools. Spot welding is usually used on fairly thin sheets to hold the pieces together without making a tight joint. It often replaces riveting at a lower cost and in a great many cases it is better. All electric welding necessarily pulls a high current and the control equipment must be carefully maintained to get day in and day out service without interruption.

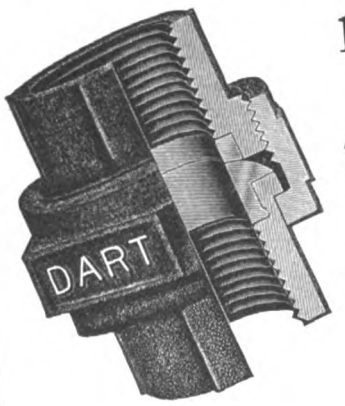
Dynamic braking is used with direct current motors for cranes and elevators to control the speed while lowering. The main advantage of dynamic braking is the accuracy of control, and with proper motor and controller sizes, the main point of maintenance is the controller, the contacts of which will require renewals. The energy generated must be dissipated by resistance, and these grids should be kept in stock for replacement if they burn out. A safety limit stop should be provided on all cranes to prevent the hoist from running up too high. This stop usually opens the power circuit and closes the dynamic braking circuit. Lifting magnets are frequently used on outdoor cranes, the main point of maintenance being the controllers which require renewals of contacts.

Out in the plant there are only a few small switchboards as a rule, and these should be well guarded with wire netting guards, or else the switchboards should be made perfectly safe with totally enclosed switches or circuit breakers. With the newer types of these accessories a safe installation can be made without the necessity of enclosing it. Insulators on switchboard work should be perfect to avoid any chance of short circuits.

When industrial electric trucks are to be charged, battery charging equipment of ample size and capacity should be installed. The best method is to have all the trucks run into the room set aside for charging at quitting time, and have an electrician stay a few minutes overtime to start the charging equipment. With auto-

(Continued on page 94)

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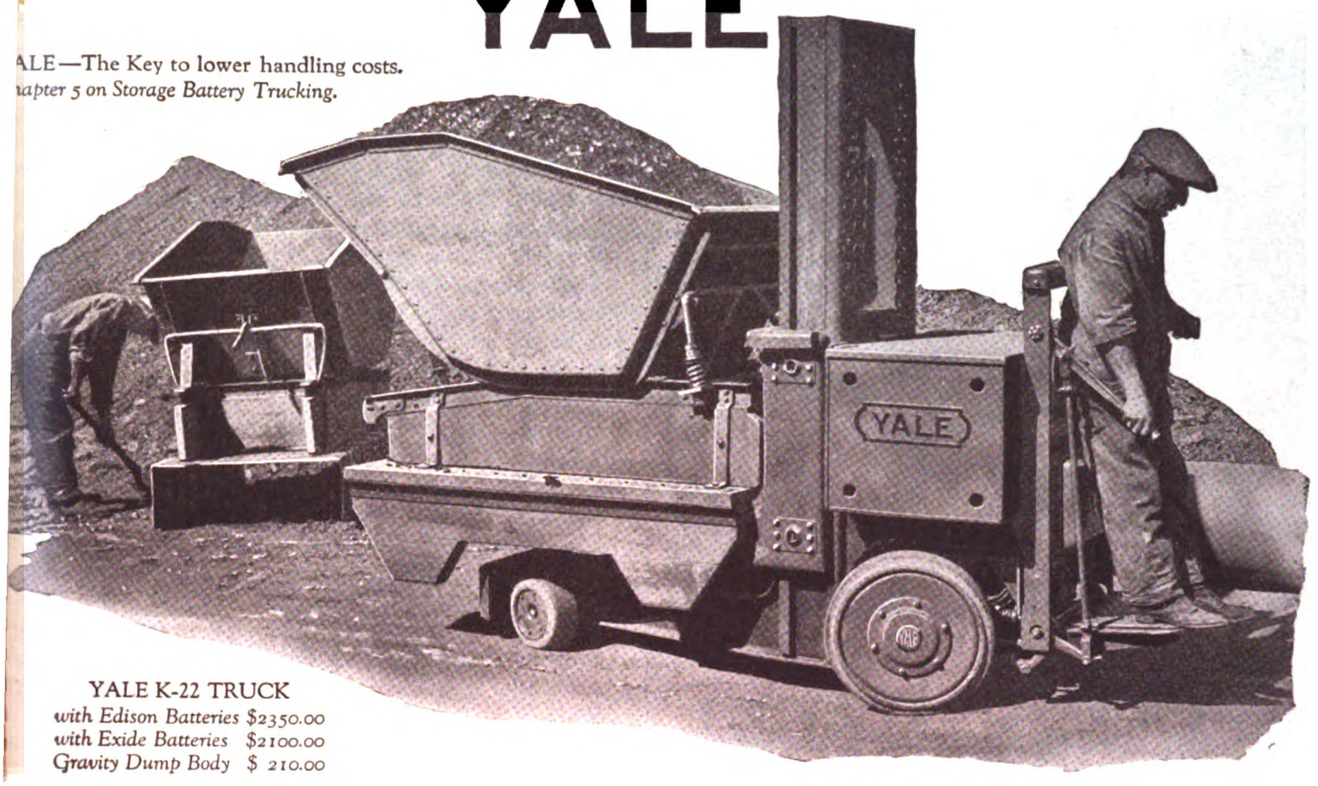
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(*Continued from page 92*)

matic operation the batteries will be automatically disconnected when the charging is completed, and there will be no danger of overcharging. With manual control, arrangements can be made to have one of the watchmen shut off the charging at a certain time. Once a week the electrician should test the water level and refill any cells needing it. The battery charging apparatus will not require much maintenance except oiling of bearings and blowing out dust on the motor-generator set.

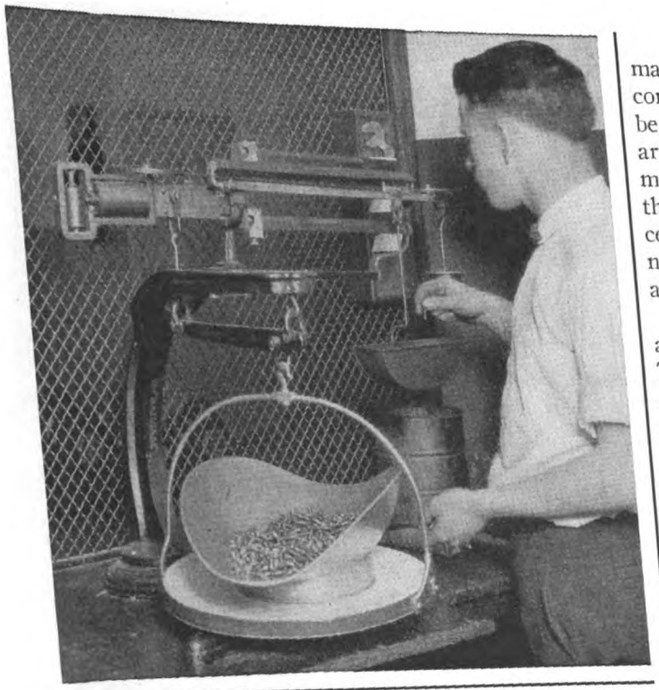
Portable electric tools are being used more and more, and new uses for them are being found every day. There are so many jobs where the tools have to be carried to the job that portable electric tools are often a necessity. The most commonly used tools are drills, grinders, blowers and hammers. Owing to the rough usage that these tools receive, there should be a reserve supply in the stockroom so that when one breaks down, another one can be issued and the broken one repaired at leisure. If both A. C. and D. C. current are used in the plant these tools should all have universal motors. The cords should have heavy protection on them and this should not be affected by oil or water. In order to save wear on the cord, reels for holding the excess length of cord are often used, especially on portable machines. These reels save kinking and consequent wear on the cords.

In many plants a master clock system is installed which controls all the "in and out" time clocks, time stamps and watchmen's clocks. On this way all time records are synchronized, but it is of extreme importance that the control equipment be maintained at a high standard so that there will be no breakdowns which would throw all the clocks out of use.

As mentioned earlier in the article an efficient system of inspection is absolutely necessary if the electrical equipment throughout the plant is to be given its proper maintenance. A daily report to the plant engineer's office shows up places that need immediate attention and gives an excellent record of each piece of equipment after the information is transferred to the card index covering all equipment.

THE vigorous start made in construction work this year is indicated by the figures covering "floor space" as compiled by the F. W. Dodge Company. Contracts awarded in January represented nearly 57 million square feet of new floor space as compared with 43 million a year ago. January contracts were at the annual rate of 684 million square feet. In January, 1923, contracts were at the annual rate of 516 million square feet, while the actual figure for 1923 was 592 million, a new high record.

Should building show the same trend during 1924 as during 1923, when the total for the year was nearly 15 per cent larger than that indicated by the January 1923, rate, the total floor space contracted for during 1924 would amount to 785 million square feet, or an increase of nearly 33 per cent over last year.—*Alexander Hamilton Institute.*



"144" S-T-O-P!
Save the 145th

IN packaging gross lots an average overcount of only one piece per gross means approximately $7.00 loss on every $1000 worth of goods sold —seven tenths of 1%.

Our years of investigation into the counting practices of practically every industry where counting is done disclose the fact that an overcount of one per gross is a very conservative estimate in cases where counting is done by average weight or other approximating methods. The variation is often much greater than this.

National Counting and Weighing Machines save the 145th piece. In addition, the labor dollars they save by greater speed and convenience of operation equal or exceed the savings on counts.

If you want your "gross" counts to stop at 144, let us tell you about National Counting and Weighing Machines.

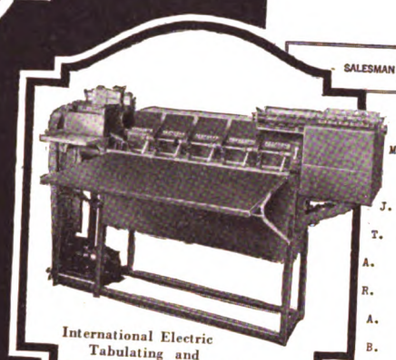
Ask for Bulletin 4 C. M.

NATIONAL SCALE CORPORATION
4 BRIDGESIDE AVENUE CHICOPEE FALLS, MASS.
Manufacturers
National Counting and Weighing Machines. National Calling System. National "Adjustable" Steel Shelving and National "Rocker-Lift" Elevating and Scale-Elevating Trucks.

NATIONAL COUNTING AND WEIGHING MACHINES

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Down to Actual Facts



International Electric Tabulating and Accounting Machine

ANALYSIS OF SALES—EXPENSES AND PROFITS
BY SALESMAN

APRIL

SALESMAN	GROSS SALES	RETURNS AND ALLOWANCES	NET SALES	COST OF GOODS	GROSS PROFITS	% TO NET SALES	EXPENSE	% TO NET SALES	NET PROFIT	% TO NET SALES
M.	21,416 83	5,716 80	15,700 03	11,272 60	4,427 43	28.2	1,789 83	11.4	2,637 60	16.8
	17,497 30	3,873 20	13,624 10	9,577 74	4,046 36	29.7	1,171 70	8.6	2,874 66	21.1
J.	15,753 81	1,160 21	14,593 60	9,135 56	5,458 04	37.4	1,984 75	13.6	3,473 29	23.8
T.	12,227 83	2,116 08	10,111 75	6,613 15	3,498 60	34.6	879 72	8.7	2,618 88	25.9
A.	10,110 70	310 40	9,800 30	6,713 17	3,087 13	31.5	774 21	7.9	2,312 92	23.6
R.	9,572 81	1,987 49	7,585 32	4,839 41	2,745 91	36.2	983 37	12.7	1,782 54	23.5
A.	8,242 18	3,416 20	4,825 98	3,373 34	1,452 64	30.1	690 08	14.3	762 56	15.8
B.	7,731 50	140 10	7,591 40	4,919 39	2,672 01	35.2	1,169 14	15.4	1,502 87	19.8
mond, S.	7,270 21	373 20	6,897 01	4,655 43	2,241 58	32.5	737 98	10.7	1,503 60	21.8
Brennan, H. A.	6,413 71	715 20	5,698 51	4,034 80	1,663 71	29.2	695 62	12.2	968 09	17.0
Reynolds, H.	5,837 02	336 08	5,500 94	3,487 07	2,013 87	36.6	720 13	13.1	1,293 74	23.5
	5,102 60	284 26	4,818 34	3,309 65	1,508 69	31.3	506 21	10.5	1,002 48	20.8
TOTAL	127,176 50	20,429 22	106,747 28	71,931 31	34,815 97	32.6	12,082 74	11.3	22,733 23	21.3

ELECTRIC TABULATING and ACCOUNTING MACHINES

EACH item on the card shown above is essential information to the executive responsible for sales organization.

This is just one of the many services performed for all lines of business and branches of industry by International Electric Tabulating and Accounting Machines. Absolutely accurate analysis at phenomenal speed decides with finality every question based upon records.

Through the use of International Electric Tabulating and Accounting Machines, original data is recorded on cards by means of punched holes. Permanent, unchangeable, stored-up records are made ready for instant or future use for any analysis required.

The International Key Punch records the data many times faster than is possible manually. The International Electric Sorting Machine arranges this data in any predetermined sequence or classification at the rate of 250 cards per minute and the International Electric Tabulating and Accounting Machine supplies from 150 to 750 additions per minute and prints either the individual items or the accumulated amounts.

Investigate the Electric Tabulating and Accounting Machine method in daily use by the greatest corporations of America and the world.

INTERNATIONAL BUSINESS MACHINES CORPORATION
TABULATING MACHINE COMPANY DIVISION
50 Broad Street New York

Offices in all Principal Cities of the United States and Canada
Members of the National Association of Office Appliance Manufacturers

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A Vital Point for the Reader of this Paper

ABP STANDARD No. 1

"To consider FIRST the interests of the subscriber."

EVERY member of The A B P Inc., of which this paper is one, has subscribed to this and to *nine other* standards covering every department of publishing practice. The A B P label stands for all that is best in publishing; the things which make a business paper one of the essential working tools of the successful business or professional man.

In interpreting Standard No. 1 the constitution bars from membership papers of free circulation, publications which are owned directly or indirectly by an association or an advertiser; and in the words of the constitution itself, —member papers "must not be organs or mouthpieces of any house or combination of houses to further its or their special interest as against the joint interest of the trade or class."

This assures you of a paper without prejudice or bias; one which must be independent of any consideration other than the common welfare of its field.

Because such a paper must have a legitimate PAID circulation, its control is wholly in the hands of the subscribers. The subscribers determine whether the paper shall live or die by giving or withholding their subscriptions.

This is not true of the paper with a circulation controlled by the ones who issue it; which goes to you whether or not it is needed or wanted. The obligation of such a paper necessarily is to its advertisers or whatever interests may be back of it.

The A B P type of paper *must* earn and deserve your approval, — you control its circulation, its life. It *must* render you adequate service; it *must* fight your just battles; it *must* deal fairly with every factor with due regard to the rights of other factors. Enlightened selfishness justifies the fullest support of such a publication.

Standard No. 1 is placed first because it IS first in our conception of publishing practice. Everything else is secondary to the main purpose of serving the subscriber with courage and unswerving fidelity.

THE ASSOCIATED BUSINESS PAPERS, INC.

JESSE H. NEAL, *Executive Secretary*

HEADQUARTERS: 220 WEST 42nd STREET NEW YORK CITY

When writing advertisers please mention Industry Illustrated

Digitized by Google

"Selling" the Company to Prospective Employees

(*Continued from page* 19)

the men and women of Western Electric have been building better telephones, they have done their share in building a greater city.

This, then, is a source of pride with us; though our product is used the world over, we are deep rooted in the life of Chicago—old timers here, in every sense your neighbors.

Here is another advertisement that gives a not too eager invitation to workers seeking a change:

"BRINGING HOME THE BACON"
AT WESTERN ELECTRIC

Every Saturday over a million dollars is put into pay envelopes at the Western Electric Hawthorne Works.

A million dollars to pay the butcher, the baker, the candlestick maker—not to mention the garage man.

Wages at Hawthorne are good and the work is steady. At least that's what thousands of men and women say who have worked here ten, twenty, thirty—yes, and forty years.

It will pay you to keep an eye out for announcements of vacancies from time to time.

How this display advertisement is coupled up with the classified advertisements, stating specifically what kinds of help are wanted is shown by a subsequent announcement from the "want-ad" pages:

THE
LARGEST INDUSTRIAL FAMILY
IN CHICAGO IS
BRINGING HOME THE BACON

at the Hawthorne Works of the Western Electric Co. Each week 30,000 workers share a payroll of more than $1,000,000

Wages at Hawthorne are good and the work is steady.

Our manufacturing program for this year is the biggest in our history.

To fill these new requirements we need etc., etc.

Another advertisement calls attention to the athletic features:

THE BIGGEST ATHLETIC CLUB
IN THE WORLD

Here's a record that Michigan Boulevard can't match. An athletic club with 31,000 resident members and some more thousands of non-resident members in all parts of the world.

Where? At the Western Electric telephone works at Hawthorne.

Western Electric doesn't believe in doing things by halves. We have one of the biggest industrial plants in the world and it was fitting that we should organize so big an athletic club.

From office boy to manager we work hard and play hard—one big team.

Some of the advertisements were slightly humorous as this one will show:

ALWAYS ROOM HERE FOR HARD PLUGGERS

The picture shows boys at the Western Electric Hawthorne Works testing switchboard cores by plugging them many thousand times. If they plug good and hard, they'll get a better job soon.

And that is true of everybody at Hawthorne. Those who do good work are bound to advance. There are bigger jobs constantly opening up for men and women who can fill them.

The harder they plug, the sooner they make good.

Still another paid a tribute to craftsmanship and gave some startling statistics:

CHAMPIONS

Champion cable makers of the world! Men at the Western Electric Cable Shops turn out 6,000 miles of cable a year. In doing so they use 2,436,000 miles of copper wire.

"Some cable," you'll say—and you're right. It's just one sign of how busy we are at the Hawthorne Works.

For telephones, switchboards and the countless items of telephone apparatus there's a great and growing demand. That brings steady work and steady pay with all kinds of opportunity for advancement.

Not all help can be recruited from the immediate vicin-



DELTA
Trade Mark
Registered Pat. Off.

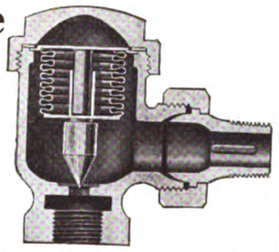
Hand and Electric Portable Elevators to handle Boxes, Barrels, Crates, Bales, Etc.

Ask for catalog 105 and let us show you the time and money saving features of the DELTA.

Unit Machines for fixed position use, make easy handling to mezzanines, etc. Any capacity, platform, size or speed.

New Jersey Foundry & Machine Co.
90 West St. New York

Check These SARCO Advantages



Noiseless. Factory adjusted. No air binding. No freezing. Prevents water hammer. Self cleaning. Easy to take apart. No blow-holes or defects in castings. Cannot break when connected. Sets at any angle. Wear is distributed over whole area of expansion element.

For vacuum and steam pressures up to 20 lbs.

RADIATOR TRAP SARCO

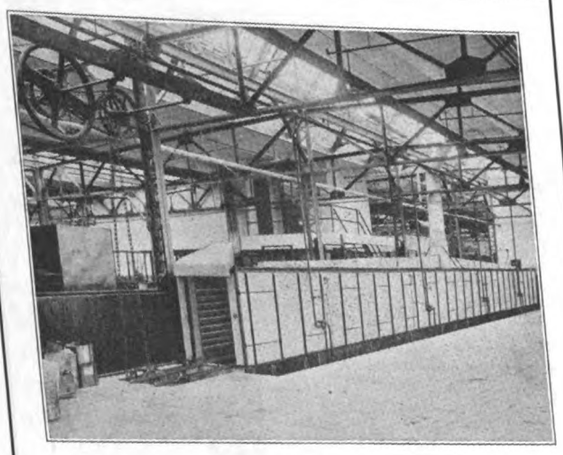
A point for point comparison of the Radiator Trap SARCO with any other make will quickly convince you of all-around SARCO supremacy.

Life-long service goes with the SARCO as well as durability and unusual efficiency.

We have described the SARCO'S many advantages in our Booklet R-114. Write for a copy today.

SARCO CO., INC.
236 Broadway, New York City
Boston Buffalo Chicago Cleveland Detroit Philadelphia

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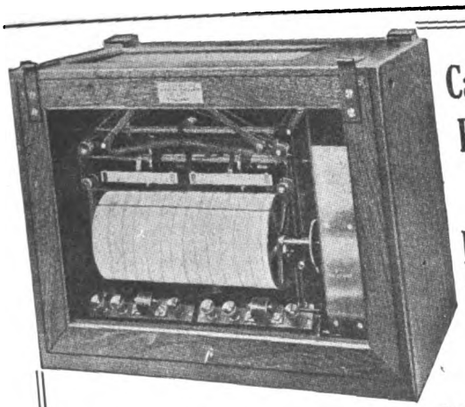
Baking and Conveying

CONTINUOUS conveyor type, non-elevated oven installed in the plant of a washing machine manufacturer, 79 ft. long with inlet end projecting into the spray room.

Machines fully baked are delivered directly into the crating and shipping room. It is indirect gas heated and was installed complete with automatic control equipment and conveyor.

Illustrated booklet describing varied installations mailed on request

The PAUL MAEHLER COMPANY
INDUSTRIAL OVEN BUILDERS
2218 W. LAKE ST. CHICAGO, ILLINOIS



Cambridge Electrical CO^2 Recorders Indicators

Four Independent Readings from Four Boilers on ONE Chart

are afforded by the Cambridge instrument shown above. This feature makes it the logical choice for the busy boiler room. By showing four CO_2 percentages on one chart time is saved and the possibility of errors in reading is greatly reduced.

Cambridge Electrical CO_2 Recorders and Indicators are extremely accurate and rapid in action and practically fool proof. They are entirely electrical —no chemicals to renew—no glass or rubber parts to break or wear out. These rugged instruments may be installed any distance from the flue. Maintenance cost is very low.

Other Cambridge Instruments—Electric Distance Thermometers, Thermoelectric Pyrometers, Optical Pyrometers, Pressure Recorders, Draft Gauges. Write for List No. 157F, containing interesting data.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC)
MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

ity of a plant. One advertisement emphasizes that it draws from a large area. A picture of a huge magnet, lying atop the works shows men being pulled toward it. The copy reads:

IT DRAWS MEN FROM ALL OVER CHICAGO

"A mighty attractive place to work," say 31,000 men and women. They have been drawn to the Western Electric Hawthorne Works by these desirable features:

1. Western Electric is a big concern—the largest telephone manufacturer in the world.
2. And it's still growing—giving opportunities for advancement.
3. Western Electric offers good pay.
4. And steady employment.
5. The Hawthorne plant has ideal working conditions—modern, fire-safe, sanitary buildings, schools, social activities and the biggest athletic club in Chicago.

Safety conditions are given a special advertisement which featured a picture of a fire gong, with the following message:

THE ONLY DRONE AT HAWTHORNE

The fire gong has a lazy time of it at the Western Electric telephone works. What with fireproof buildings and inspections going on all the time to guard against fire, it hardly ever gets into action.

This ought to interest men and women who look for safe working conditions. It is one of many indications of the safeguards to life and health which are the rule at Hawthorne.

And that explains why thousands of people have liked their jobs here well enough to stay from five to thirty and even forty years.

Special advertising is prepared for graduates about commencement time. One of these contains a picture of a boy looking through his diploma which has been rolled into a conical tube.

TO GRADUATES WHO CAN LOOK AHEAD

This is written to the man who has faith in the future, who can see that humble beginnings often lead to great achievement.

If you are not afraid to start near the bottom and work up, the Western Electric Company offers you a far-reaching opportunity.

In Chicago and in a technical and commercial organization which covers the whole world, Western Electric will need big men to carry on its big work through the years to come.

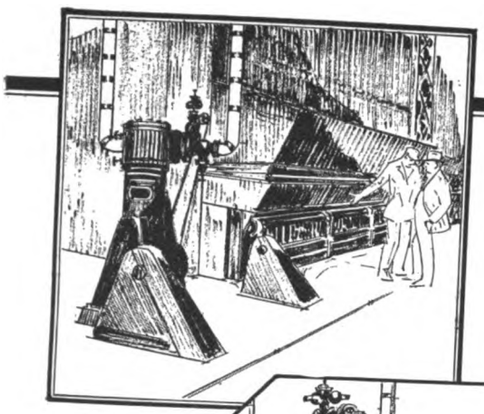
Going after the worker in this manner—giving him some real information about the concerns and working conditions, advantages, prospects—is not a matter of a single advertisement.

It is a phase of educating the worker about his job and needs several lessons.

THE recommendation of the Secretary of the Treasury for reduction of Federal taxes was based upon some important facts confirmed by experience. One is that all very high taxes are grudgingly borne by the taxpayers, and that they yield less revenue, proportionately, and often actually, than do lower tax schedules. There is the natural human instinct to regard high taxes as unfair, and the rich and prosperous who pay them feel as if they were singled out for excessive impositions because of their supposed financial ability to bear more than their relative share of the burden. Ways and means are usually found, most of them strictly within the law, to evade a large share of such burdens, evidence by heavy investments in tax-exempt securities to avoid the present high surtax.

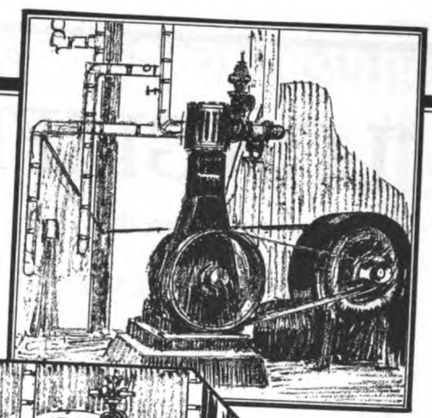
These tax-exempt securities represent loans of capital that are, on the whole, not so productive of wealth as are the loans represented by taxable securities. Much of the money otherwise invested in tax-exempt securities would naturally go into productive enterprises.—*La Salle Extension University.*

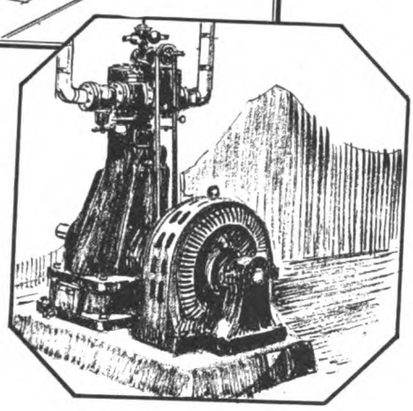
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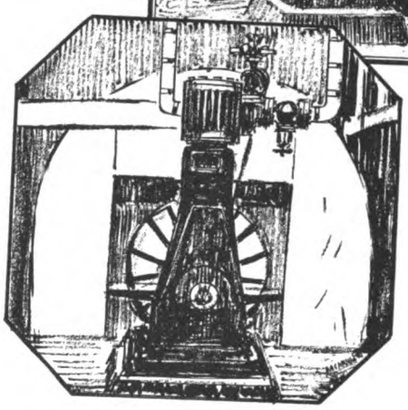


TROY

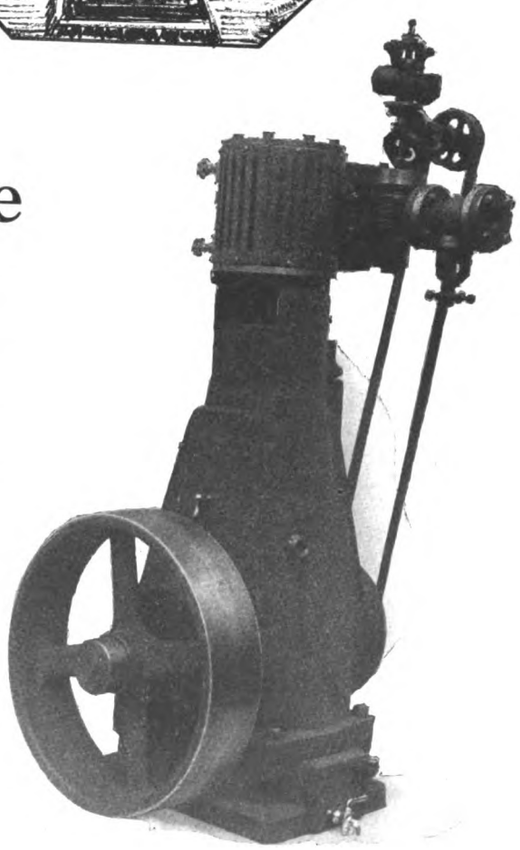
ONLY STEAM ENGINES GOOD ENGINES ONLY







For Every Industrial Purpose



Industrial executives who are scanning production costs closely are also aware of the savings that can be effected by the proper selection of equipment used for power purposes.

The Troy Engine meets every requirement of modern boiler room practice. Whether for driving stokers, fans, blowers, pumps, compressors, as auxiliaries to the larger prime movers, or direct connected to electric generators the Troy is built for economical operation and hard usage, due to day in and day out service.

For the plants equipped with high pressure boilers and superheat the New Troy has been developed. Thus Troy has kept pace with engineering progress. The new Troy is especially adapted to drive modern stokers. Of extra heavy construction with large overload capacity, it meets every demand for greater power in smaller space.

All Troy Engines are equipped with the Troy system of Automatic Lubrication, which supplies each bearing with an abundance of oil. Also, the Balanced Valve which relieves the cylinder of any condensation—assuring absolute safety.

Write for catalog

Made in sizes from 2 to 200 B. H. P.

TROY ENGINE & MACHINE CO.
TROY, PA.

TROY ENGINES

Dependable Power with Absolute Safety

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"LONGLIFE"

used on the

Largest Conveying Unit in the World

The longest straight-run conveyor system yet conceived is now being completed by the H. C. Frick Coke Company. It will carry coal on a series of 48-inch belts from a loading point 400 feet below ground level through a tunnel to tipples nearly four and a half miles distant.

The magnitude of this project, and the solution of its many engineering problems, mark it as the highest achievement in the development of conveyor practice.

THE B. F. GOODRICH RUBBER CO.
Akron, Ohio

Goodrich

"LONGLIFE"
Conveyor Belts
"Best in the Long Run"

TRADE MARK
LONGLIFE

American Industry and the Immigrant

(*Continued from page* 27)

terest, great hope and often tragedy. Last year, for example, 100,000 emigrants passed through the principal railroad station of Paris, largely from countries east. They had staked everything on this one great adventure, but many had been cheated and robbed en route. One large group had been sold Paris subway tickets, at the price of railroad tickets to the ports, by some fake railroad agent. Some of their more fortunate companions, on arrival at the port, could go no further, for their money had been spent, their tickets lost or the monthly quota (not more than 20 per cent of the yearly allowance) was full. And this meant a long wait in a strange city, where sharks and grafters are ready to fleece the poor emigrant twenty-four hours per day. And so it is in all embarkation cities.

I shall never forget my visits to the homes of emigrants in the interior. The houses of the little villages in Czecho-Slovakia were tinted white, blue, yellow and green, and had picturesque straw-thatched roofs. Little girls in long dresses were running around taking care of the geese. "Nazdar!" ("Good-luck!") they called as we drove by. A stream of people were coming home from church. The women were dressed in the most beautiful costumes, with elaborate embroidery. The men wore heavy wool or felt trousers, and wool or leather vests and coats, also beautifully embroidered, and hats with the inevitable flower or feather stuck in the hat bands. The fields were fertile, the wonderful Tatra mountains shone white in the distance, and all was peace. This was a Sunday morning in Slovakia!

A month or two later on Monday morning some of these same people would be working many hours per day in blue overalls in the steel mills or coal mines. What a contrast! Between these two extremes there is a great gap. Many people of Europe are trying to fill up this gap with merciless exploitation, and, unfortunately, exploitation does not cease when the immigrant arrives in "the land of the free."

When will we realize that the way in which we treat these immigrants in America determines not only their future value as industrial workers and citizens, but also that it has a tremendous influence upon the countries of Europe? Many of them eventually return and settle down near their old homes. They carry back American ideals and methods, good or bad, according as they have found them. In southern Italy my attention was arrested one day by a sign: "*Coney Island Barber Shop.*" I talked with the proprietor, a returned emigrant, and found that his greatest impression of the United States was Coney Island. He had returned with Coney Island ideals, instead of the best American ideals.

In many other countries I discovered similar illustrations. And the more I conversed with these emigrants the more convinced I became that it was largely our fault rather than theirs that they had not absorbed the best in America. Many others, however, have gone back with the "real thing," and are exerting a powerful influence for good in their respective communities. And it is encouraging that some of our best immigrants never return, but remain here, gradually fusing into

(*Continued on page* 102)

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National Biscuit Co. uses 38 Stuebings!

The question no longer is "Will lift trucks save us money in material handling?" For industry is daily proving that there is no question about it!

The only thing that remains to be determined is "How can we save the *most* money?" And that question, also, is rapidly being answered.

Five years ago, on April 17, 1919, the National Biscuit Company started to answer that question for themselves. They purchased their first Stuebing Lift Truck and put it to work in their New York plant. Side by side with other lift trucks this Stuebing did *more* than its share of the lifting and hauling, for it had no days off in the repair shop.

It carried their heaviest loads without a whimper; and its positive-acting hydraulic check eased the loads to the floor with velvety smoothness.

What was the natural result? Another order for Stuebings! And order followed order until, today, *38 Stuebings* are in constant uninterrupted service.

Does the National Biscuit Company know what lift trucks will save them the most money? 38 Stuebings are proof that they have answered that question beyond the shadow of a doubt!

If you want to make all the saving possible, with *your* material handling equipment, specify Stuebing Lift Trucks and "Steel-Bound" Platforms. Use the coupon below and let us send you a copy of our new 36-page catalog.

THE STUEBING TRUCK COMPANY
Cincinnati, Ohio Cornwall, Ontario
Branch Sales Offices in all Principal Cities



8 Reasons Why You Should Buy a Stuebing Side Lift

1 *Side Lift*, for convenience. A lifting and steering range exceeding that of any other side lift truck built.

2 *Easy Lift*, for power. Stuebing engineers have developed a lifting leverage that far surpasses anything heretofore accomplished. Smoothly working parts are also a factor. An anti-friction bearing in fork column makes steering easy.

3 *Single Lift*, for speed. With a single stroke *one man* can lift with ease a load that, heretofore, required several strokes, with effort.

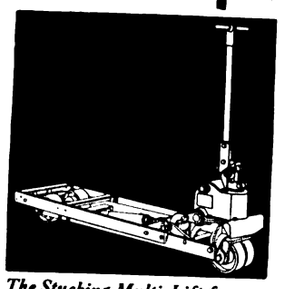
4 *High Lift*, for emergencies, to clear inclines, elevator crossings and for rough floors.

5 *Four Wheels*, for stability. Prevents bulky or high loads from upsetting. Protects floors and provides longer life to truck.

6 *Steel Construction*, for great strength. *Simplicity, few parts.* Standard Stuebing construction assures the long wear and low upkeep that make your lift truck savings *real.*

7 *Safety*. The only trucks with double-acting safety device. Counterbalanced handle provides quick and easy operation. Handle cannot fall to the floor or fly up.

8 *Guarantee*. Warranted against breakage of any part through defective workmanship or material, regardless of the number of years in service.



The Stuebing Multi-Lift for use where loads are heavy. Its lifting leverage gives one man the lifting strength of 88 men, and it pulls easily on its Hyatt-equipped wheels

StueBing
LIFT TRUCK SYSTEMS

The Stuebing Truck Co.
Cincinnati, Ohio
Without obligation, please send me full information concerning: Single Lift Truck ☐ Multi-Lift Truck ☐ Side Lift Truck ☐ "Steel-Bound" Platforms ☐

Name.....

Address.....

Nature of Business.....

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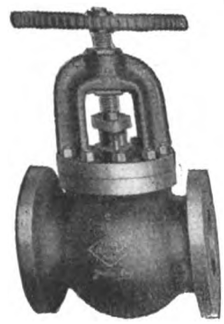


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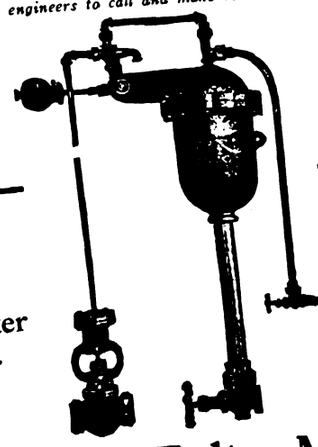
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(*Continued from page* 100)

the economic, social and political life of the nation.

In Prague I met a Slovak who had worked in New York, Boston, Detroit, Philadelphia and Scranton. In the last city he had learned most of his English. He proudly produced the very book he had used in the Y. M. C. A. night school. "See," he said, "this my best book! Some day I be citizen—then I get better job, and vote for President!"

It is fascinating to trail the immigrants from Czecho-Slovakia, the new republic of 14,000,000 people; from Poland—now an enormous country of 150,000 square miles and 30,000,000 inhabitants; from Jugo-Slavia, composed of Serbia, Croatia, and old states of Austria-Hungary, with over 12,000,000 people; from Austria and Bulgaria, greatly contracted by the peace treaty; from Turkey and Greece; from the new Baltic States, now independent republics; from Scandinavia which furnished so much of our earlier emigration but where the governments now prefer to have their people stay at home; from Germany, hard-pressed, but boasting two of the greatest emigrant stations in the world. The one at Hamburg contains 30 buildings and covers many acres. Bremen is almost as large. In 1913, the last normal year, over 239,000 emigrants embarked from the latter port. Holland, Belgium and France send us few immigrants, while most of the people from Spain and Portugal go to South America. As for Italy, her greatest exports are emigrants. In 1913, she sent over 428,000 across the seas. Last year her nationals forwarded to their mother country approximately $250,000,000 earned in American industries.

This is all the more surprising when we consider that most of the emigrants from Italy and other countries are peasants. Yet they undertake the most unskilled tasks in our mines, quarries, factories and construction camps. With all their faults, they have their good qualities and we can ill afford to do without them in some of our unskilled occupations.

Let no one get the idea that it is a quick jump from Balkan peasant to West Virginia miner! The prospective emigrant must secure all sorts of permits—medical, penal and military certificates before he can, after considerable delay, secure his passport. Then he must obtain a vise from the nearest American consul, who may be two days distant. After selling all his precious possessions, except what is essential for the journey, he weeps his farewells and sets out on the great adventure. It takes him far longer to reach the sea port than the ordinary traveler, and at every frontier he must get out, day or night, and submit to passport and baggage examinations. At the port he is housed at a company or "private" hotel—where he is thoroughly "deloused" and examined by steamship company doctors. The United States Health Service representative gives the final examinations and "bill of health" to the ship, and, at last, our emigrant crosses the gang plank. After a hard trip, he reaches Ellis Island, passes a literacy test and several medical examinations. If he is not debarred for any one of several dozen reasons, or subjected to "S. I." (examination by a board of "Special Inquiry"), he passes on to the money-exchange room, railroad room, and then aboard a ferry which takes him to New York City or a Jersey railroad terminal from whence he takes a train inland. Finally he arrives, tired, discouraged, speechless, with many forebodings of the

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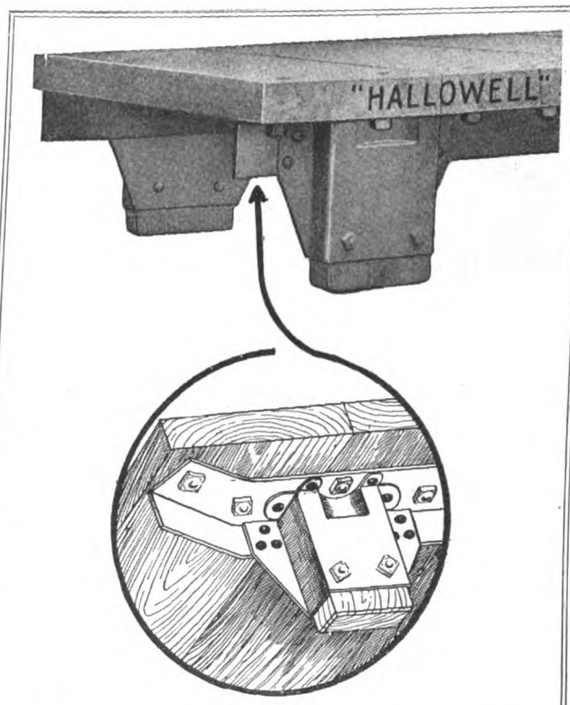
future. It is, indeed, a long, tedious, but necessary process—this changing from emigrant to immigrant—in one sense a "survival of the fittest!"

Though there are many people in Europe who exploit the emigrant, there are a few agencies to protect and serve him. One of these few is the Y. M. C. A. There are American or native secretaries in most of the countries of origin promoting general Y. M. C. A. work, and also advising emigrants, where necessary. This is done without in any way stimulating or retarding emigration. Other secretaries serve the wanderers at frontier towns and ports of embarkation. Still others promote educational and recreational activities on board some of the ships and assist the immigrants at Ellis Island and other ports of entry. Several hundred secretaries cooperate in American cities through classes in English and Citizenship attended by over 100,000 last year; indoor and outdoor lectures enjoyed by over 1,000,000; and many other activities which make up a comprehensive program of Americanization.

We could better understand the immigrants who are now coming to us of we could picture more clearly the present conditions in their fatherlands. Great changes are taking place. There is everywhere a tendency toward greater democracy. I visited a splendid boys' camp in Poland with headquarters in one of the Czar's old hunting palaces. The main quarters of the palace were being used as dormitories and the old wine cellar was the dining room. In Czecho-Slovakia, I witnessed one athletic meet which lasted for a week, and during which there were ten thousand participants, and 125,000 spectators every afternoon. I spent one day in a refugee camp, near the Bolshevik frontier, in Poland. There were 12,000 refugees in camp, some of them clothed in flour bags or burlap. A Red Cross girl told me she had given out the last clothing available, and did not know where more was coming from, yet the refugees were pouring in at the rate of several thousand per day. Many of these people had been to America. Here they thought they were Bolshevists. They had returned to Russia to enjoy Bolshevism at its best. They had "enjoyed" quite enough of it. "If ever I get back to America," said one, "I am going to get a job and become a good citizen!"

In other countries, as well as in Russia, people have had no good food or clothing for a year or more. One of our workers just returned from Petrograd tells of his first-hand impressions of the terrible conditions. Many students are endeavoring to live on one meal a day.

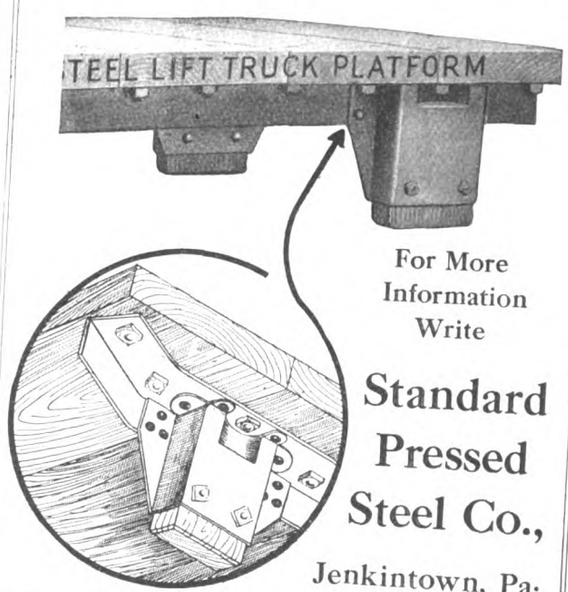
Were it not for the work of the European Student Relief, thousands of students in many countries would starve. The president of one Russian University earns in five months just enough to buy one pair of shoes! Two students often wear the same suit on alternate days. In many ways, the needs of Europe today are far greater than during the war. The Quakers in a single week in Germany fed over a million children in 8,000 different centers in 1640 different cities. Those who are suffering most in Germany, Austria and Russia are the very people who *least* wanted the war, and who *hate* Bolshevism with a hatred far beyond any hatred which we can understand! The only way to improve conditions in these countries in a permanent way is to help the better and more democratic elements in the population to win their great fight against the old forces of militarism and greed. And in this fight the returned



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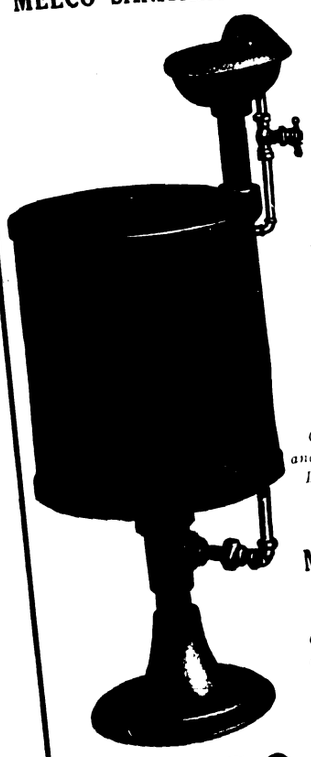
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emigrant, who has experienced American democracy, is frequently a real leader.

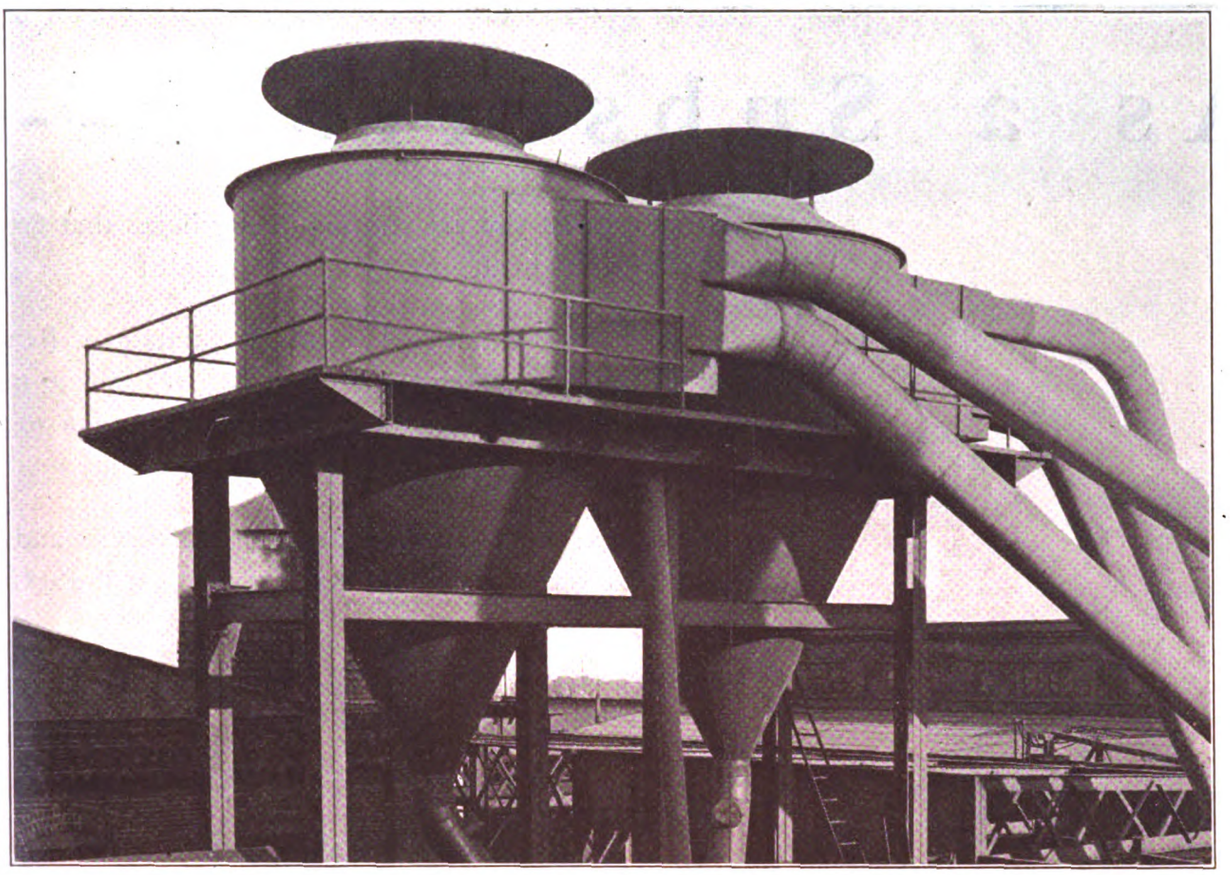
Europe, as I look back upon it, seems a mass of desolation, of international hatred, misunderstanding, distrust, yet, it is a vast area no part of which is without tremendous possibilities. Whether for good or ill, will be determined largely by America's attitude and actions now and in the future years. Europe is not in eclipse. The work of Herbert Hoover, the relief organizations and the great Christian and social agencies like the Y. M. C. A., the Y. W. C. A., the Quakers, the Red Cross, and the World's Student Federation, with its splendid student welfare program, has done more to restore confidence and faith in America than any thing else. These are the agencies which have held up before the eyes of suffering Europe the *real* America, the America of unselfishness and good-will to all people regardless of race, creed or nationality. These are the agencies which are making many people in Europe thankful that America lives. Sooner or later we will realize that we must go to Europe even to mind our own business! A high government official said to me, "We shall never forget that you, who have been our enemy, have fed our starving children and given clothes to our suffering students." For the good-will which lies behind such a statement as this we should be very thankful.

We owe this good-will, in no small measure, to many returned emigrants who, as paid or volunteer workers in many of these organizations, or in private life, have helped to interpret the real America. This has increased my conviction that one of the best ways to help Europe, as well as America, is to treat our immigrants in just and brotherly fashion, in factory and community, to *attract* rather than compel them to citizenship, and to recognize and utilize the splendid qualities which they bring.

A LENGTHY series of vivid and striking educational motion picture films, depicting the mining, preparation and utilization of the various mineral materials, is made more readily available to the public through a new system of distribution, arranged by the Department of the Interior, by which the many industrial films made by the Bureau of Mines may be obtained through state or sectional centers of distribution.

Nearly a hundred educational films have been prepared in the past few years by the Bureau of Mines in coöperation with industrial concerns. The demand for these films for showing by educational institutions and civic bodies has become so great that the original plan of centralized distribution from the Pittsburgh Experiment Station of the Bureau of Mines has become inadequate. A selected list of the best of these films is now made available at twenty-seven coöperating agencies located in the different states. The films relate to coal, petroleum, sulphur, iron, asbestos, zinc, marble, copper, natural gas, and other minerals. A series of films depicts most vividly such industrial processes as the manufacture of oxygen, the making of fire-clay refractories, the manufacture of automobiles, the methods of compressing air, the quarrying of limestone, etc. Other films illustrate dangerous and safe practices in mining, efficiency in the combustion of coal, the utilization of water power, and the operation of a gasoline motor.

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BRILL COMPANY REDUCES PAYROLL $36,000 ANNUALLY CARRYING WOOD WASTE BY AIR

J. W. Rawle, Vice-President of the J. G. Brill Company, Philadelphia, Pa., says:

"As the largest builders of electric railway cars in the world, we have always been quick to introduce into our plant devices which would promote the safety and health of our employees and at the same time make for greater efficiency in our production. With both of these thoughts in mind, we installed a Sturtevant dust and waste collecting system in our wood working shop at our Philadelphia plant. Our equipment now consists of five Sturtevant Blower fans driven by motors ranging from 50 to 150 horse power which gather the waste materials from 73 circular and band saws, planing machines, sanding machines, and other wood working machines.

The waste is drawn through pipes ranging in size from 14 inches down to 7 and 8 inches—and in length from 60 to 150 feet and is first sucked and then blown to two separators, 44 feet in height, which drop the waste directly into any or all of the four fire boxes in the power house. It is impossible to estimate the tonnage of waste material handled, but an idea can be gained when it is known that better than 6,000,000 feet of common lumber, teak, mahogany, rose wood, and other woods go through the various machines each year.

The saving in the health and safety of the workingmen is not calculable. Needless to say, keeping the air free from flying particles and fine dust has made our wood working plant a better place to work in and has reduced our labor turnover. Without the equipment we would have to have one man for every two machines to gather up and remove the waste. This means a saving of 36 men or approximately $36,000.00 a year in wages.

Without the waste collectors the machines would have to be stopped every so often to be cleaned. Conservatively estimated, this would mean a reduction in production of 15%. Further, the waste material is so effectively removed that it is reflected in fire insurance premiums as well as in accident prevention. It would be impossible to operate an efficient and safe wood working plant without such equipment as Sturtevant have provided us with here. In our long acquaintance with the equipment, our experience has been that it is always satisfactory in every way."

Catalog 291 Is Full of Pneumatic Conveying Suggestions

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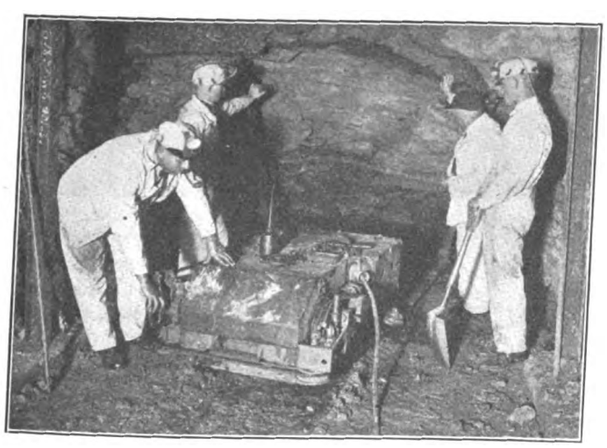
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Teaching Modern Mining Methods

By Robert H. Moulton

AS a result of the constant disorders in the coal mining industry, between operators and miners, a great effort is now being made to stabilize the production of coal. When stabilization comes the whole country will be benefitted. There will be fewer mines, and, of course, fewer miners; but the miners will be skilled workers, earning steady wages, and will be happier. The whole industry will be raised to a higher degree of efficiency. A tremendous amount of capital now invested in mines operating only a part of each year, will be available for other enterprises. Strikes, which are due primarily to unsteady labor, will at least be fewer.

Another important reaction resulting from the elevation of the coal industry will be in the personnel as a whole. Mining as a vocation, will appeal to many more

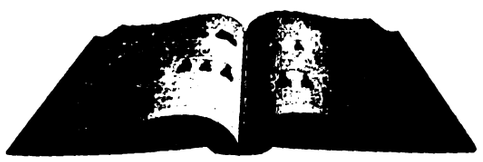


men than it does now. Constantly recurring disorders and unsteady work have kept many young men from the mining fields. That it has a strong appeal as a profession is agreed, and stabilization will strengthen its appeal.

Progressive educational institutions realize this condition. An established coal industry opens up to the coal mining schools opportunity to educate the young mining engineers needed in one of the greatest productive industries of the world.

Occupying a unique position in so far as opportunity is concerned, is the Carnegie Institute of Technology, Pittsburgh, Pa. At Carnegie, a coöperative department of mining engineering has been established for several years. The department has courses, not only for mining engineers, but for young miners desiring to train as mine foremen and fire bosses—for young men limited, perhaps, in means and education, to become executive workers. All of the work done by the department of mining is on a coöperative basis with two units. One is in connection with the United States Bureau of Mines, the experimental station of which is located adjacent to the college and which is the largest and most modern station in the world. The other association is with an advisory committee composed of mine operators and engineers in the Pittsburgh district.

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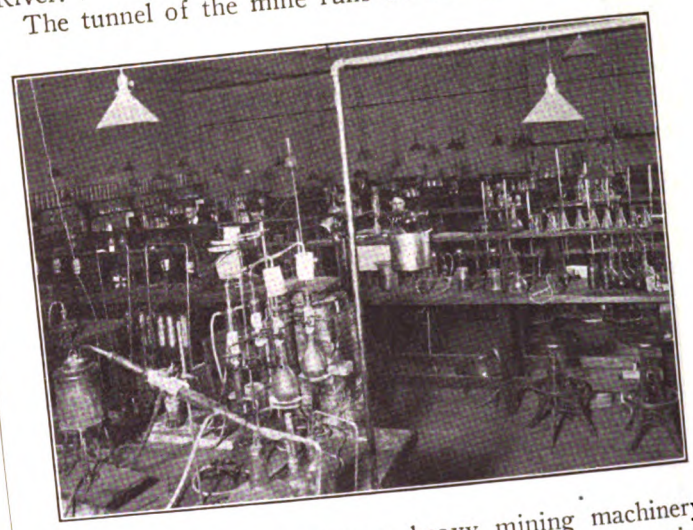
The Joseph Lay Company
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RIDGEVILLE INDIANA

"They hold their shape till worn to a stub."

numbering 20 members, advises on all matters pertaining to the mining courses. This advice aids in giving to the courses of instruction the practical and business features which are necessary to develop the type of mining men especially needed at this time.

In the coal mining courses at Carnegie, students are not taught solely by the text-book method. Instead they are given real experience in mining, and they don't have to go any farther than two flights of steps to get actual drilling and excavating experience. Beneath the college of engineering, which houses the department of mining, is the only mine in any college east of the Mississippi River.

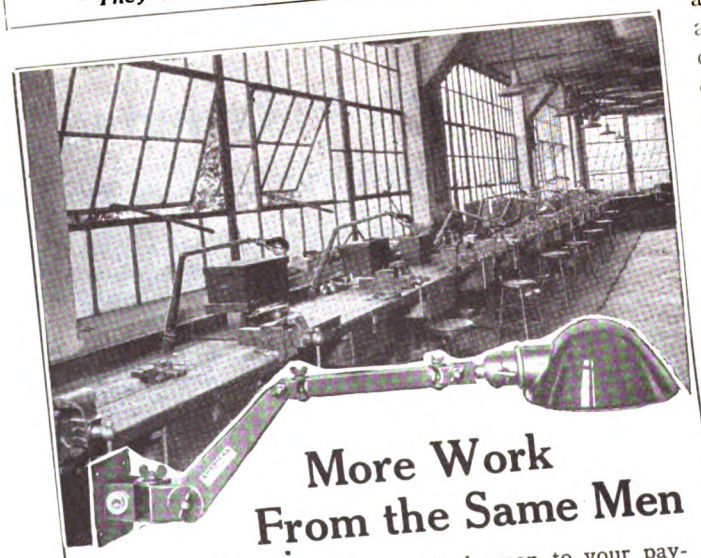
The tunnel of the mine runs off the third or bottom



bench, of what serves as a heavy mining machinery laboratory. A 42-inch gauge track with trolley wire accessories extends, at present, 200 feet into a timbered and concreted tunnel which enters the hillside in the direction of the campus. The equipment of the mine consists of a trolley locomotive, storage battery locomotive, coal mining machines, forge, welding apparatus, modern lights and heavy electric drill, etc. From the mouth of the tunnel the track extends out of the laboratory and 75 yards along a hillside. The mine tunnel runs through clay and solid rock. Drilling through an upper half of rock and the lower half of clay and extension of the tunnel are regular parts of the mining course.

Another important development in this industry, a study of which had gradually made mining a science, has been metallurgical mining. During the last half

(*Continued on page* 110)



More Work From the Same Men

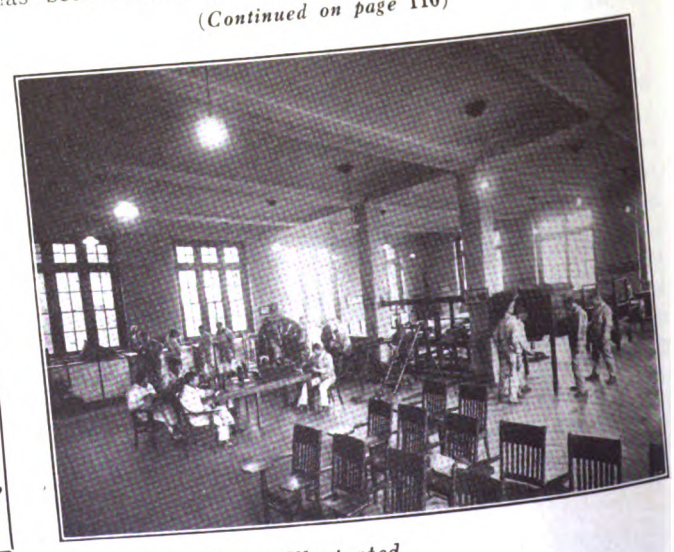
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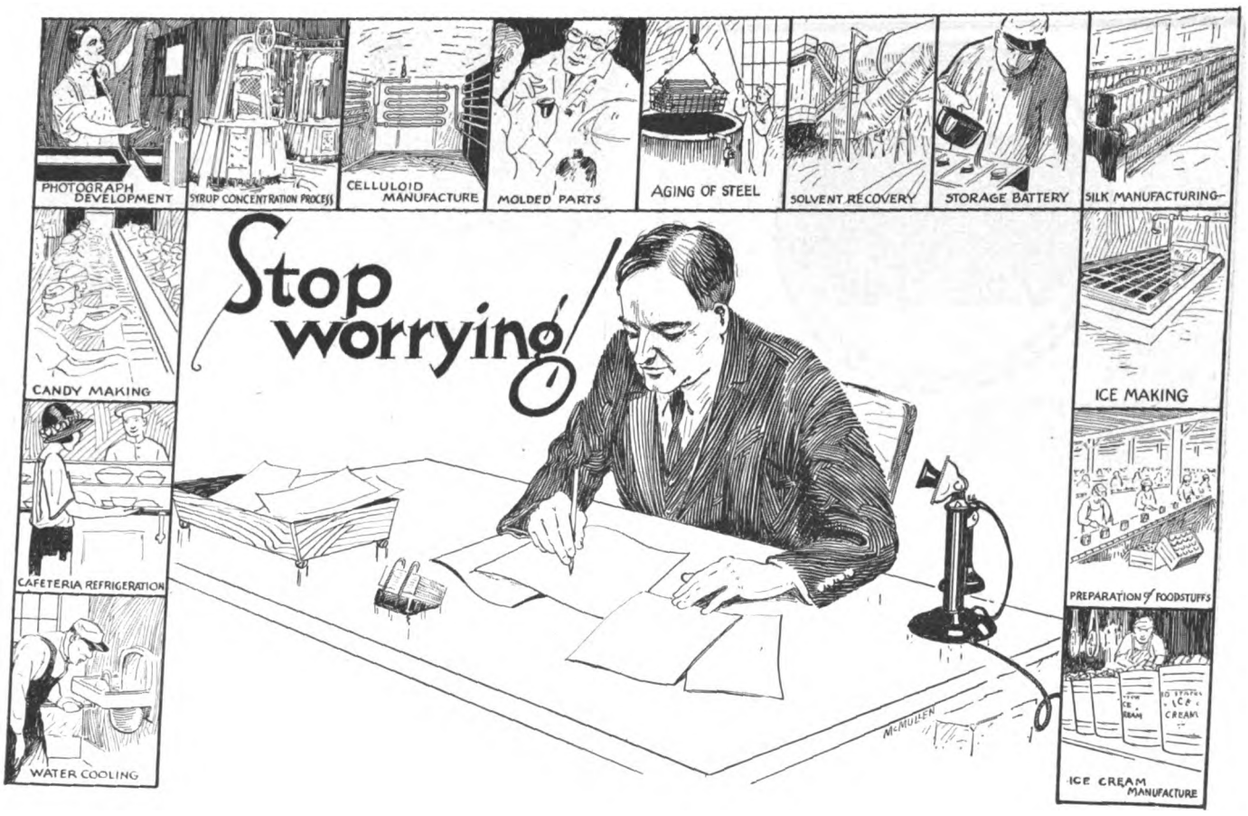
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Many concerns have abolished the old fashioned ice cooled drinking water methods for refrigerated drinking water at a big yearly saving. A steel manufacturer in quenching steel, a large Candy Manufacturer in maintaining a constant humidity, a chemical plant that prepares edible oils and hundreds of others discovered that their processes had use for Automatic Refrigeration. Hence the list at the left.

New applications are constantly being discovered. And in some instances this process of Automatic Refrigeration has saved upwards of $3,000 a year, enough to pay its cost of installation in a short time and then pay a good profit.

Keen calculation may save you many *cold* dollars through Automatic Refrigeration. Look over this list. See if any of these uses apply to your plant. Check them and send in the coupon. This Refrigeration System deserves investigation.

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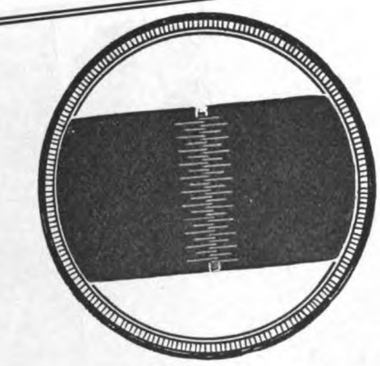
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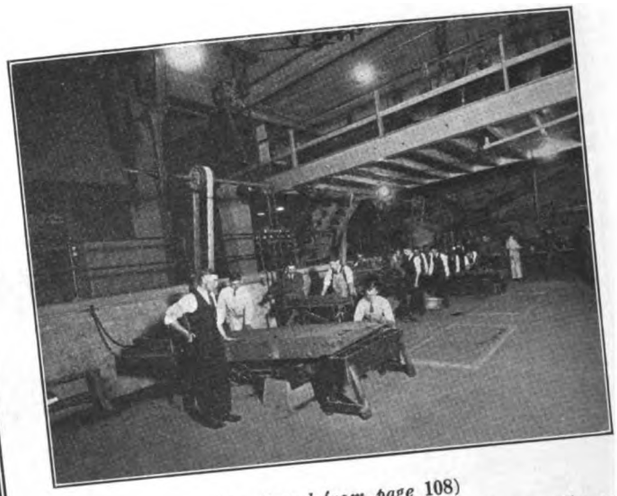
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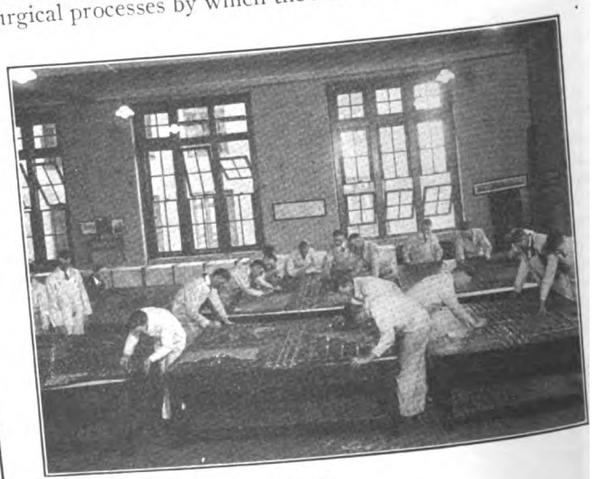


(*Continued from page* 108)

century there has developed a line of work, usually carried on at or close to the mines, but which may properly be considered as belonging to either mining or metallurgical engineering. Material as mined may and usually does contain a variety of minerals, some of them in undesirably large quantities. The important art of coal washing or dressing is at the present time undergoing development.

The art of ore-dressing consists in partly separating by means of various expedients, desirable minerals from undesirable so that only the former may be subjected to transportation charges or to metallurgical processes for extraction. By utilizing various characteristics of minerals—brittleness, friability, specific gravity, electrical conductivity, magnetic attraction, adhesiveness, etc., in a score of ingenious ways, ore-dressing helps to convert otherwise valueless or undesirable material into highly profitable ore or mineral. It is this art that has made possible much of the immense growth of the mining industry during the last 30 years. Comparatively few metalliferous mines are without concentrating mills as an indispensable adjunct.

As the result of the recent developments in mining, the mining engineer must have an exceedingly broad and thorough technical training. In addition to his knowledge of underground work, he should be able to design, construct, and operate a treatment plant which shall furnish the ore to the smelter or the coal to coke ovens in the best possible condition for subsequent treatment. Mining students are now given a knowledge of the metallurgical processes by which the metals are extracted from



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ores. Laboratory work is used to stimulate powers observation and reasoning; and some practice is given surveying.

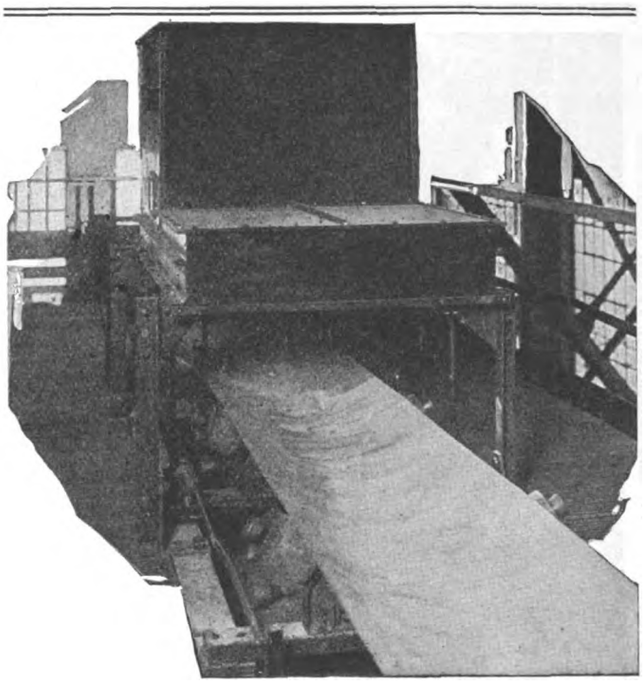
The field is large, so large that mining engineers frently find it desirable to specialize in some particular nch. One man makes a specialty of examining and uing properties; another man becomes expert in nomical operation of mines; while a third makes a cial duty of the geological side of mining. Each line ers ample opportunities to a capable man, and the ustry of mining must necessarily grow with the wth of population and civilization.

THE idea of obtaining steam power from the heated center of the earth is not practicable at the sent time, according to Dr. Thomas T. Read, of the partment of the Interior, who, with F. C. Houghten, the research laboratory of the American Society of ating and Ventilating Engineers, has prepared for Bureau of Mines a report on the cooling of mine

In descending beneath the surface of the earth the perature increases continuously with depth at a rate ying from one degree Fahrenheit for 70 feet in th to one degree in 250 feet, according to the region re it has been measured. Men have ascended over miles above the surface of the earth: if they could go miles below the surface in a shaft that deep, a region igh temperature would be reached, and it would seem hough it ought to be possible to utilize that heat as a ce of power, free and perpetual. Sir Charles sons, the inventor of the steam turbine, has sug- ed that it is possible, but Dr. Read considers that difficulties involved would make the power thus ob- ed too expensive to compete with coal.

The principal difficulty is not the cost of penetrating o great a depth (though a shaft 5 miles deep would $5,000,000 or more), but the fact that the amount eat that can be derived from hot rock is not pro- ional to its temperature, but is limited by the con- ivity of the rock. Comparing the heat with water ing through porous rock, it is evident that the unt of water that can get through in a given time ot dependent upon the amount of water available, ven on its pressure, but depends chiefly on the sity of the rock. The heat conductivity of rock is and in order to get any considerable quantity of through in a unit of time the area of surface ex- d must be large.

ne second important difficulty depends on space; eat is available five miles below the surface, but n only be usefully employed on the surface and how t it there without losing most of it on the way is roblem. One suggestion is to pass water down, and late it through large galleries at the bottom, thus g it time to take up the heat, even at the slow rate ansfer that exists. This would give us water at a temperature and pressure, but at the bottom of the , where it is no more useful than ice is in the polar ns. In rising to the top of the shaft, the hot water d cool down at about the same rate as it heated n descending. Even with extremely efficient (and nsive) heat insulation on the up-going pipe, so much e heat would be lost that what remained would not for the cost of getting it, at least until coal and sources of power are much more expensive than are now.



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If you had provided Van Dorn Safes, they with their cargo of live records could have been wheeled into the next room, and your work could have gone right along. Business doesn't consist of *things*. It consists of *activities*. And all the tools of your activities should be locked up safely *every night!* May we send Safe Catalog?

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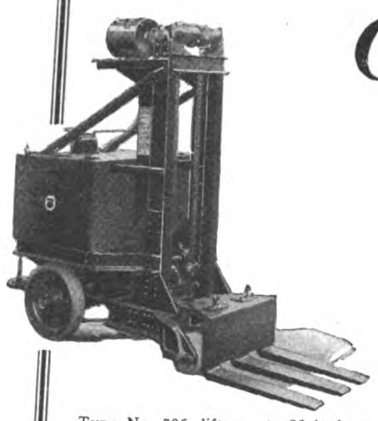
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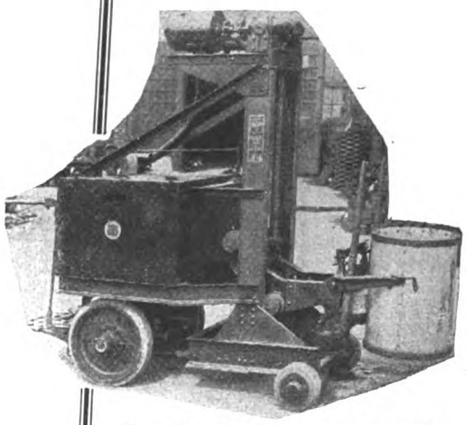
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The Tier-Lift Can Handle Anything



Type No. 706, lifts up to 80 inches, with fork attachment for carrying loads without using skids.



Type No. 706, with arm attachment for carrying loose material in standard containers.

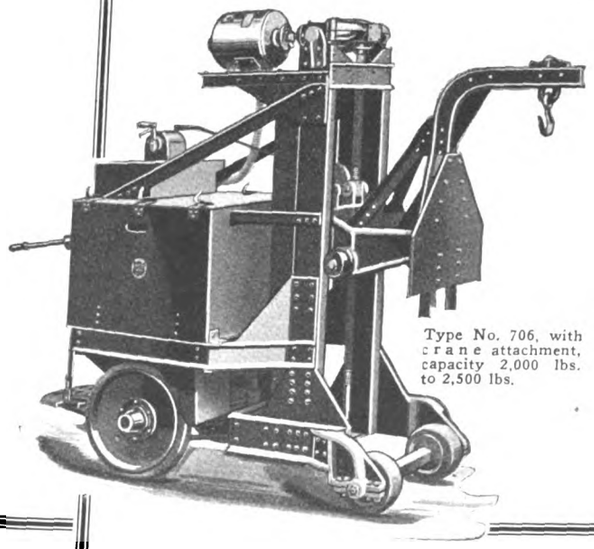
Bags, sheet metal, castings, bales, boxes or anything—The Lakewood Tier-Lift carries and lifts more quickly and at less cost.

Wherever used, Tier-Lifts save $2500.00 to $5000.00 per year—and they are used in nearly every industry.

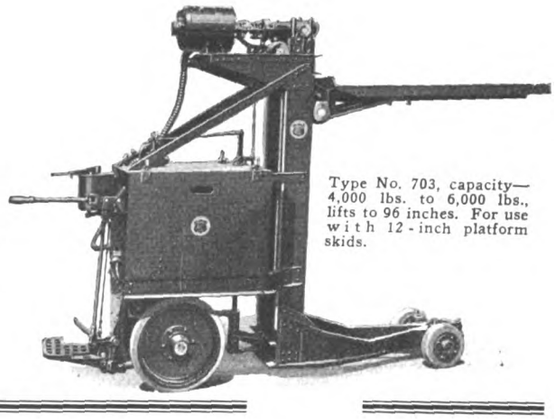
Look around you, on your next walk through *your* plant. Wherever you see a *man* moving a load, a Tier-Lift will do it for less.

Savings effected by Tier-Lifts may make a sizeable sum in a year. Let's estimate for you just what it might be.

No obligation—Drop us a line.



Type No. 706, with crane attachment, capacity 2,000 lbs. to 2,500 lbs.



Type No. 703, capacity—4,000 lbs. to 6,000 lbs., lifts to 96 inches. For use with 12-inch platform skids.

The LAKEWOOD ENGINEERING CO., CLEVELAND

Originators and Patentees of the Tier-Lift

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This



Cannot Happen With a Plimpton Lift Truck

Because



1—Built like an automobile, a Plimpton offers continuous four point load suspension. Thus load weight is equally distributed and there is no danger of tipping on turns.

2—The maximum breadth of truck top assures quick and safe handling of even the highest loads. The cupped platform tends to interlock the units of the load during transit.

3—A vertical lift in combination with aligning wheels and platform legs provides ample leg clearance with the least load elevation and lifting effort. The surrounding wheels and legs pass over an elevator sill together.

4—The Plimpton is practically a load length truck with all its wheels and mechanism compactly under the load, permitting its use in the smallest elevator.

5—Platform costs are materially reduced because the Plimpton truck top gives all round support and thus permits the use of lighter platform boards.

6—The Plimpton has right angle turn steering knuckles. Also a spring plunger mechanism in the tongue which automatically retains the handle in a vertical position when not in use. The oil operated release check with superimposed reservoir controls easy lowering of heaviest loads.

7—The angular shaped top with rounded corners facilitates entrance to platforms and saves rebacking.

In addition to these seven features, repairs on a Plimpton Lift Truck are practically nil, and everywhere the savings in trucking have been remarkable. In fact one manufacturer reports $60.00 per day saved in trucking costs—$21,600 per year.

Plimpton Lift Trucks have been in use over 10 years in American and Foreign government departments, railroads and internationally known firms throughout the world—sold on merit alone, without advertising. Our enlarged facilities now enable us to supply Lift Trucks for practically every conceivable plant or warehouse use.

Manufactured in 33 sizes.

Write for booklet describing the various sizes and industrial applications.

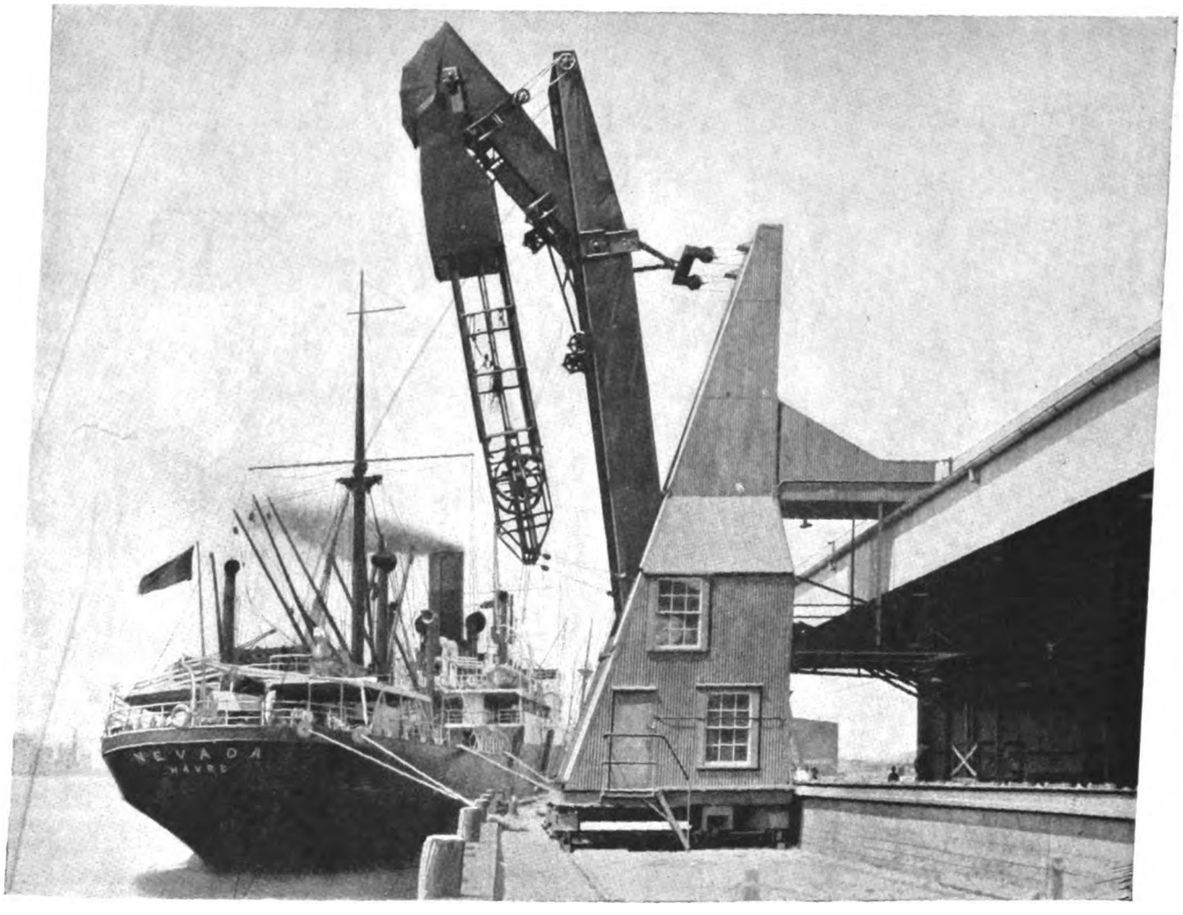
The Plimpton Lift Truck Corporation

Sales Division Stamford, Conn., U.S.A.

Representatives in Principal Cities of U. S.

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12,000 bunches
of bananas unloaded every hour

TO unload a ship of bananas used to require three days, with an army of men passing the fruit from shoulder to shoulder. For three days, the ship was idle at the dock, and the investment was earning no return.

Today, the Cuyamel Fruit Co., New Orleans, unload the same ship of bananas in a few hours. And only a small crew of men is required for unloading, as the actual handling work is done by the Lamson unloaders, one of which is shown in the picture.

Besides the enormous saving in men, the system also saves two days every time the ship is in dock. The ship gets under way with its return load two days earlier, and earns correspondingly greater dividends.

The use of mechanical handling equipment in warehouses, factories, docks, and shipping points has barely begun. Some of the biggest opportunities for making money lie in the use of this equipment.

The last few years have been an era of profit making through perfection of machinery—the next few years will see similar profits made through perfection of material handling methods.

If you move goods in quantity, you need Lamson equipment. You may require a complete system, like that used by the Cuyamel Fruit Co., or perhaps a simple portable conveyor that you can move wherever needed may serve your purpose. Whatever your requirements, we should like an opportunity to study your present methods, and help you select the type of equipment best adapted to your needs.

THE LAMSON COMPANY
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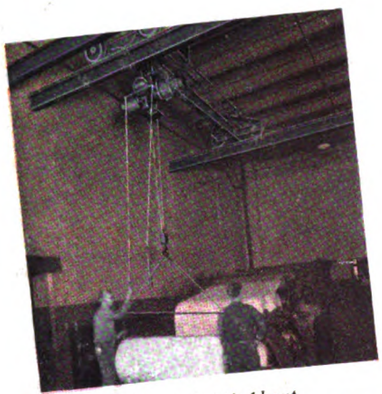
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for every lifting and load-moving requirement—

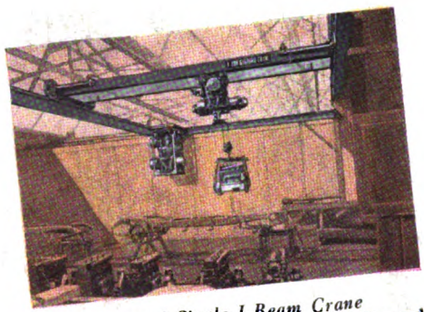
Write us

Overhead, out of the way, without taking up valuable floor space, that is the way Shepard Electric Cranes and Hoists operate. Carrying heavy, bulky loads of every description about a plant, indoors or out, these sturdy cranes and hoists provide a sure and safe load-moving service.

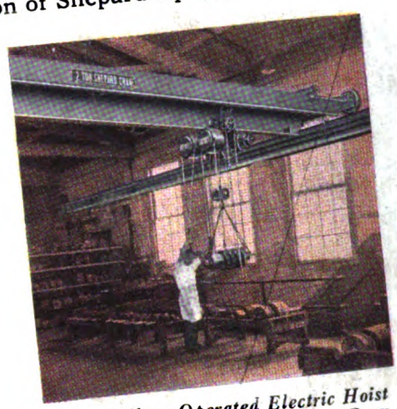
Illustrated below are just a few typical installations, merely suggesting the wide range of application of Shepard equipment.



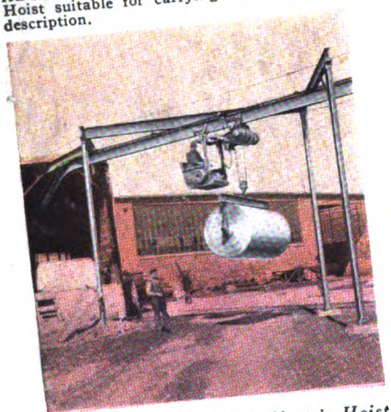
Shepard LiftAbout
traveling on a Shepard Single I-Beam Crane, handling heavy paper rolls in the cutting room of a paper mill. The LIFT-ABOUT is a sturdy ½ and 1 ton Electric Hoist suitable for carrying loads of every description.



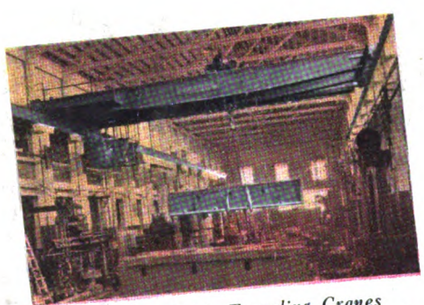
Shepard Single I-Beam Crane
A Shepard Electric Hoist traveling on a Shepard Single I-Beam Crane, as shown above, with remote control, provides a low-cost load moving combination that will carry loads quickly to any part of the bay. The operation is in control of one man—by manipulating control levers, he moves the load in any direction.



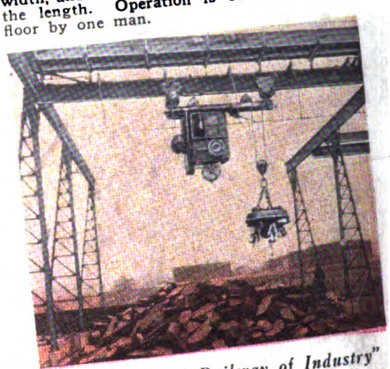
Shepard Floor-Operated Electric Hoist
running on a 2-ton Shepard Single I-Beam Crane, moves loads anywhere in the shop. The hoist traveling on the crane covers the width, and the I-Beam on its runway covers the length. Operation is controlled from floor by one man.



Shepard Cage-Operated Electric Hoist
traveling on overhead monorail track. This provides a speedy and sure method of handling heavy, bulky loads. Here, a load is being carried from one department to another.



Shepard Electric Traveling Cranes
Balanced Drive, permanent alignment, thorough, automatic oil bath lubrication, complete enclosure and accessibility—all typical features of Shepard design—provide what you most desire in crane operation—SERVICE.



Shepard "Aerial Railway of Industry"
This is a combination of one or more Shepard Cage-Operated Electric Hoists, operating on Shepard Transfer Cranes, switches, and monorail track. It carries loads "through without change."

From the above illustrations you will readily realize that the Shepard line of electric cranes and hoists is a comprehensive one. Learn more about the savings you may accomplish in your plant with Shepard Equipment. The coupon at the right is for your convenience. For complete information just check the coupon opposite the equipment that interests you.

SHEPARD ELECTRIC CRANE & HOIST CO.
420 Schuyler Ave., Montour Falls, N. Y.
Branches in Principal Cities.
Member Electric Hoist Mfrs.' Assn.

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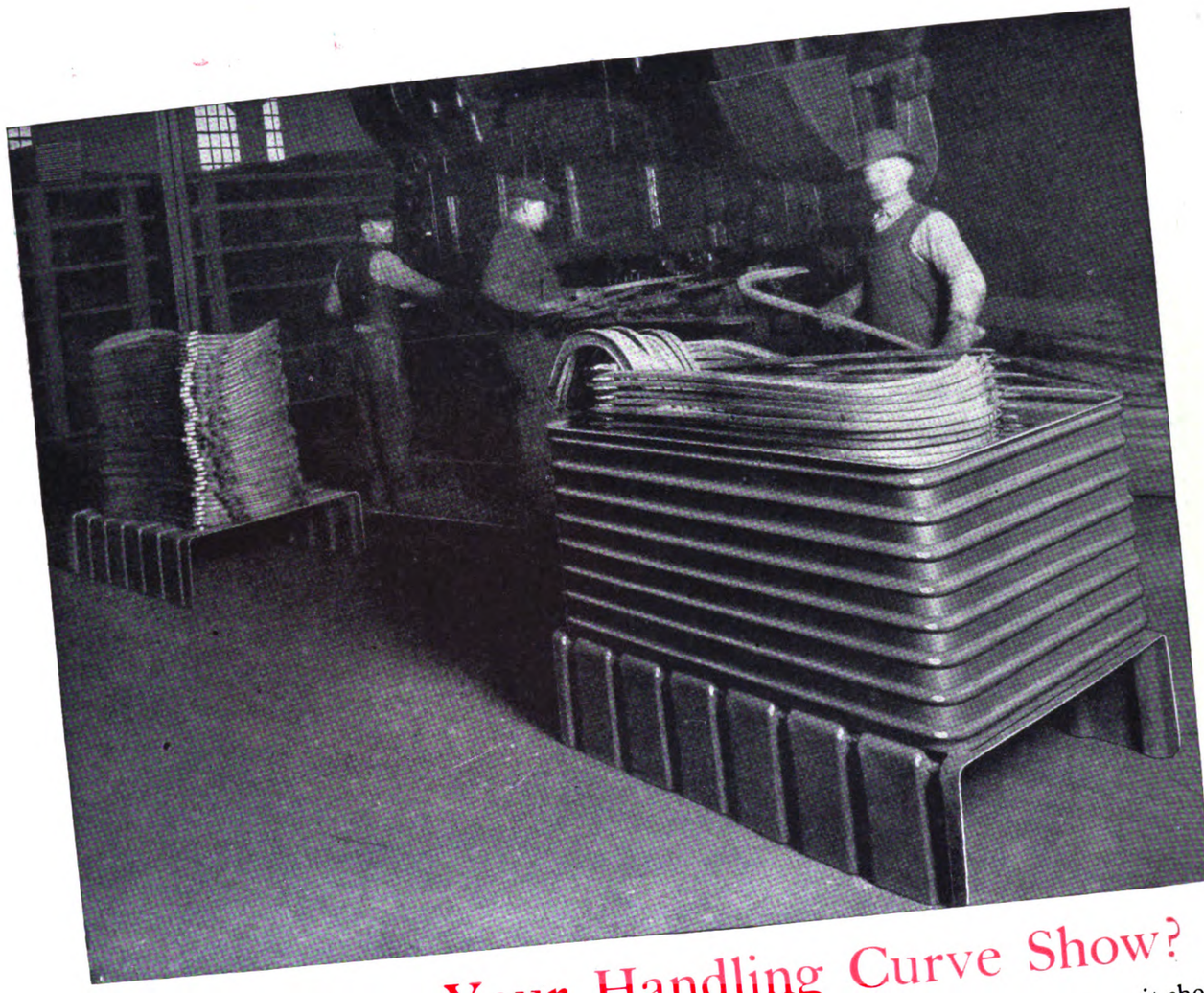
Reg. U.S. Pat. Off.



In This Issue

What Is the Best Type of Roof?

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What Does Your Handling Curve Show?

Is your material handling curve running up or down? Does it show high costs for handling and rehandling?

The photograph above gives a graphic illustration of an efficient method of handling material. If such material were piled on the floor directly from machines, the time of at least two men would be necessary in the average plant in later rehandling this.

With Truscon Steel Platforms and Boxes handling costs are cut—less labor needed. Materials are placed directly from machines onto either the platforms or boxes. They are moved quickly and easily.

Clear aisles and increased output are the results.

Truscon Platforms and Boxes are made from heavy steel, ribbed to hold white hot metal, and they will last for years under the hardest usage.

Let us give you additional facts on material handling for your particular business.

These nationally known firms are using an aggregate of more than twenty-five thousand (25,000) Truscon Alloy Steel Boxes and Platforms.

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The Singer Manufacturing Co.
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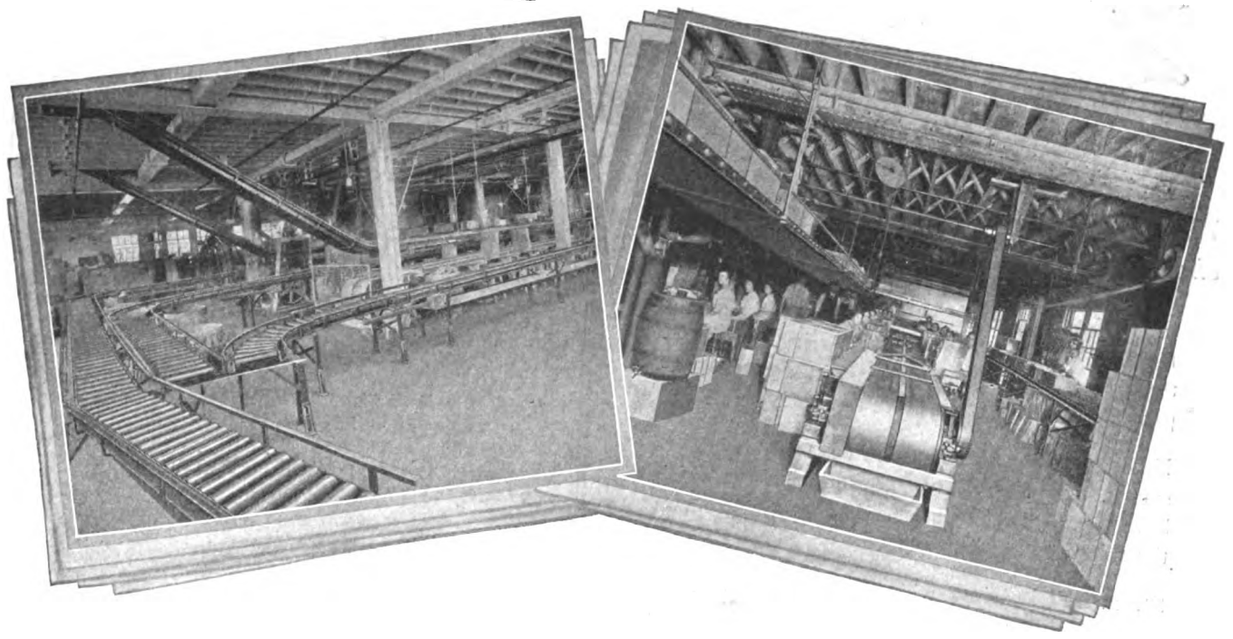
TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO

Special Pressed Steel Dept. representatives in New York, Philadelphia, Chicago, Pittsburgh, Cleveland, Buffalo, Detroit, Boston, St. Louis

TRUSCON ALLOY STEEL PLATFORMS AND BOXES

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Van Camp's SINCE 1861 – another user





The photographs at the top show some of the Dow Gravity and Belt Conveyors which carry Van Camp's products through various plant operations and to packing and shipment.

THE profitable sale of any household commodity depends upon wide distribution. To effect wide distribution, volume production is necessary. Volume production is not possible without the most efficient, expeditious and economical methods of transporting materials and finished products through every phase of manufacture within the plant. The Van Camp Packing Company has chosen Dow Conveyors for this purpose. Hundreds of other nationally known manufacturers have done likewise. Does this suggest a possible saving of time, labor and money in *your* business? Ask our nearest office.

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DOW LOUISVILLE CONVEYORS

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Strom
BALL BEARINGS

An Old Company but a New Name

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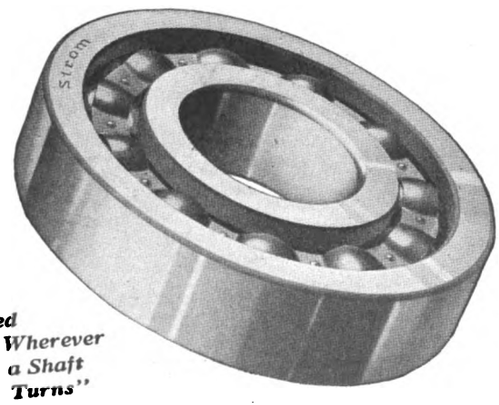
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1—A Barber-Greene Conveyor and Loader at the Clinton Iron & Steel Co., handled 400 tons of ore in a day. They are doing work that men would not do.



2—A Barber-Greene Conveyor, with cleated belt, handles lump coal at the J. S. Davis Coal Co., Toledo, Ohio, storing it well back from the tracks. It unloads a car of mine run in an hour.

3—Before the Miamisburg Light, Heat & Power Co. bought this Barber-Greene, there was demurrage on one or two cars out of every three received. There has been no demurrage since.







4—Replacing a steam shovel with a Barber-Greene Bucket Loader, for loading coal and cinders at the Pennsylvania Edison Company. It loaded 109 tons in four hours, with only two trucks running over a two-mile haul.

5—Barber-Greenes at work in the Hunt-Spiller yards in Boston. They unloaded an 800-ton barge of molding sand in 2½ days.

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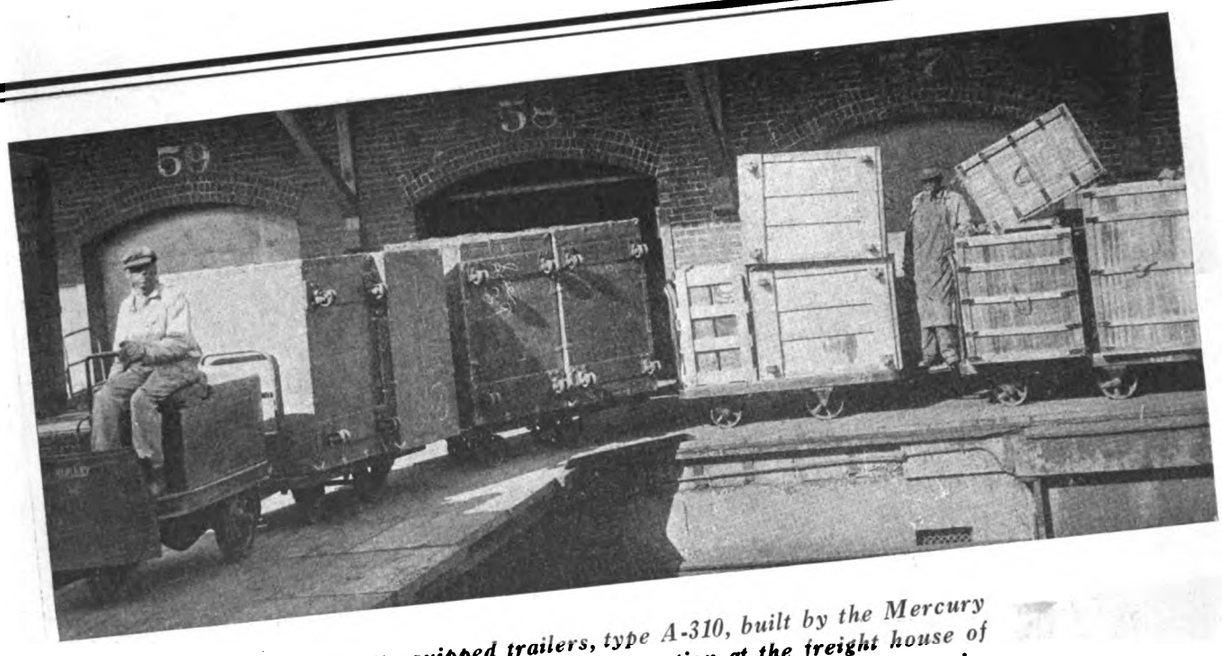
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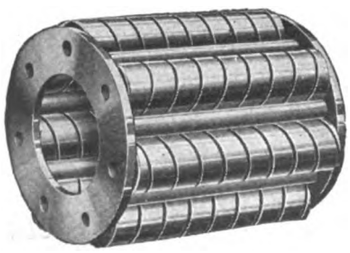
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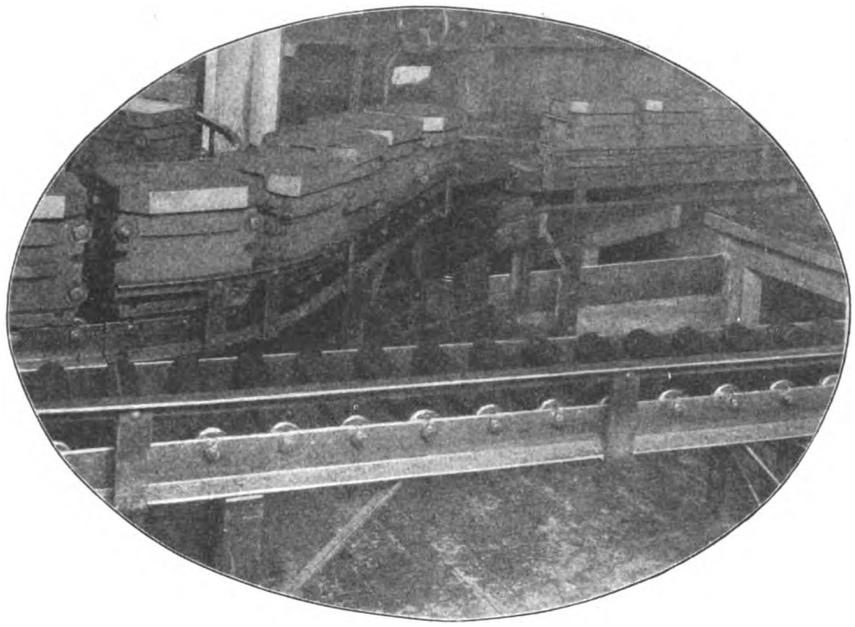
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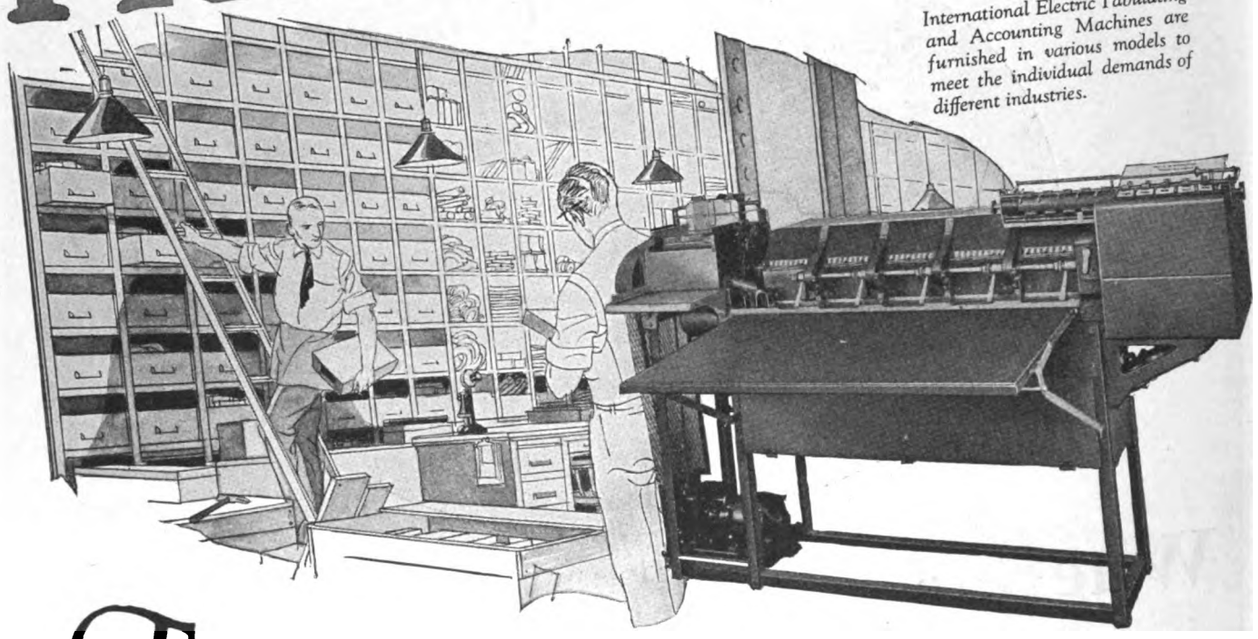
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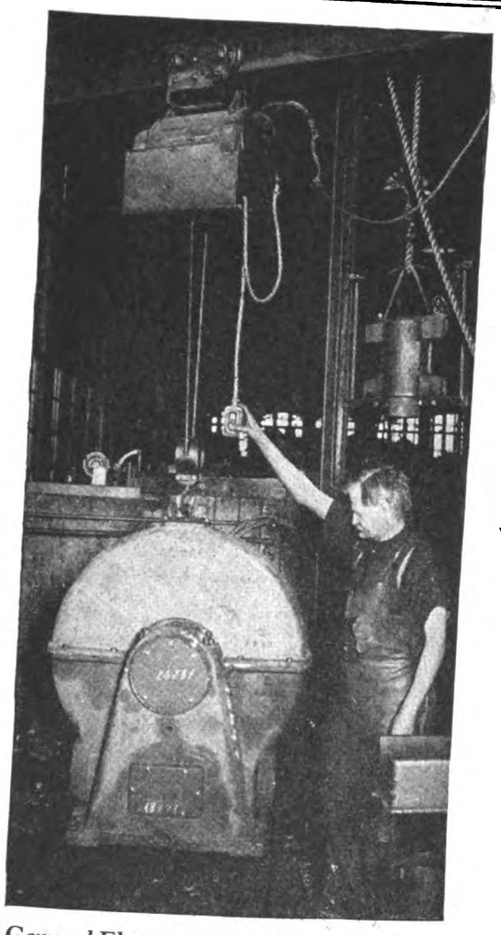
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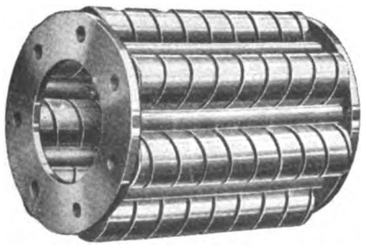
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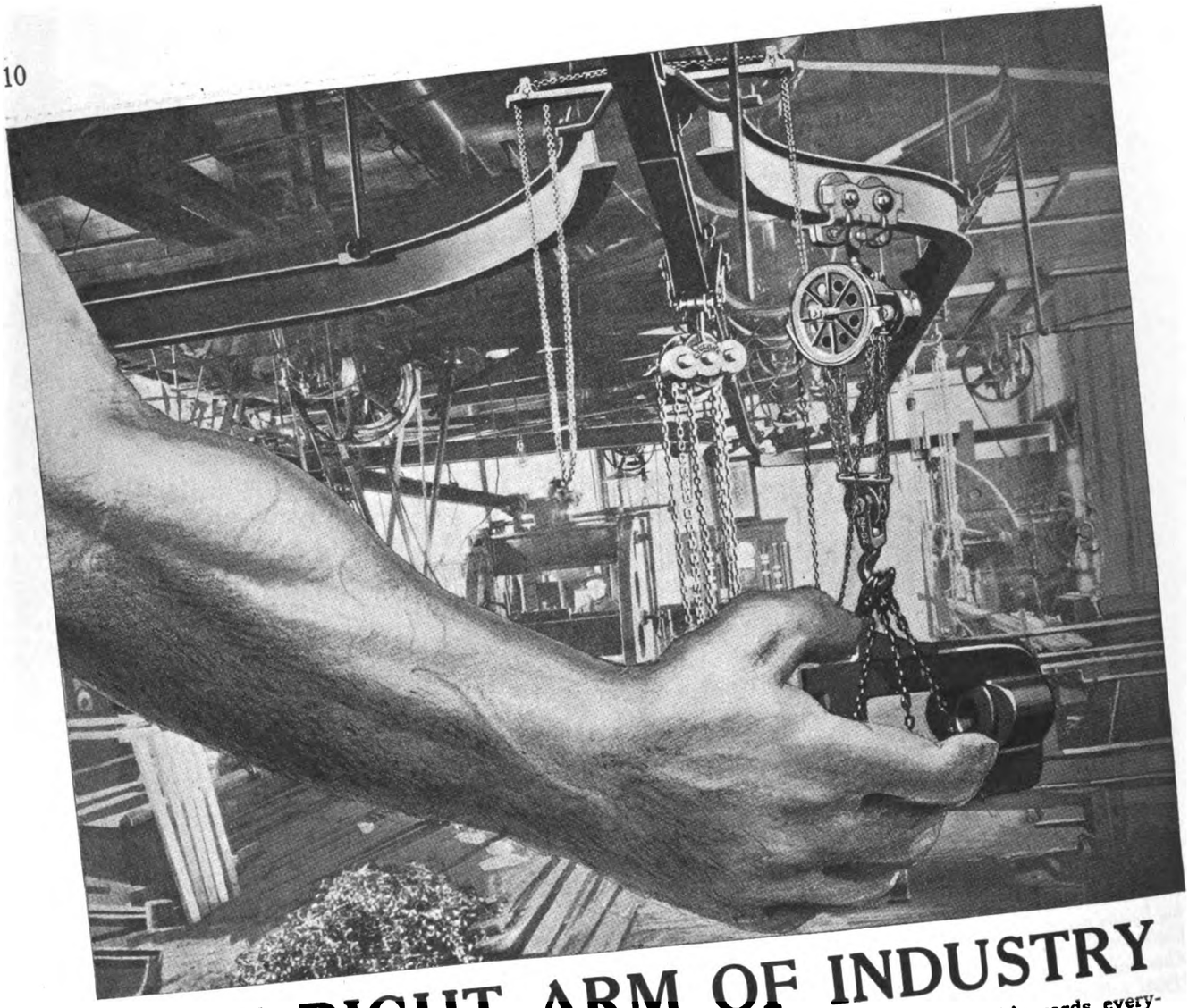
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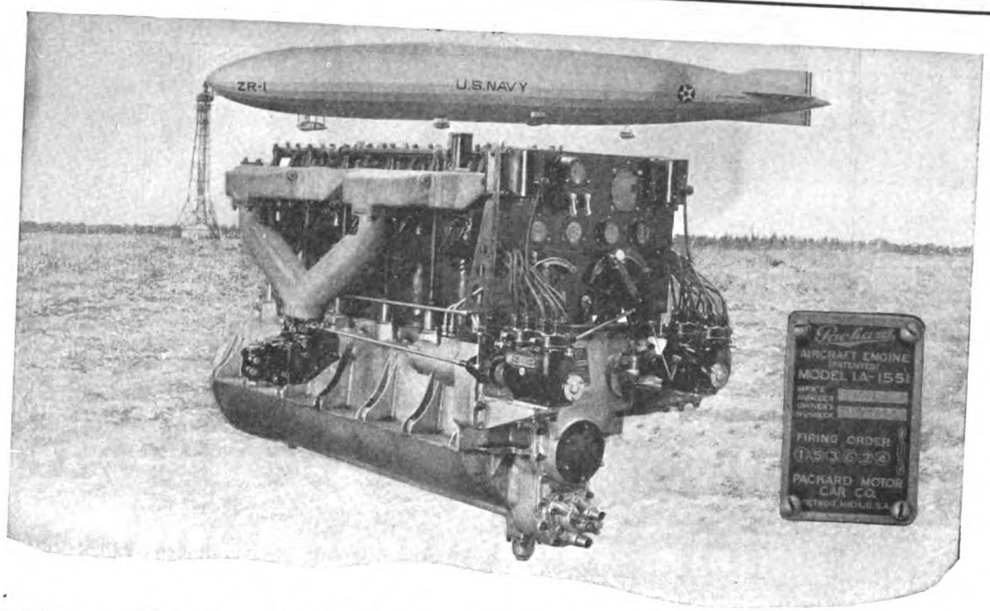
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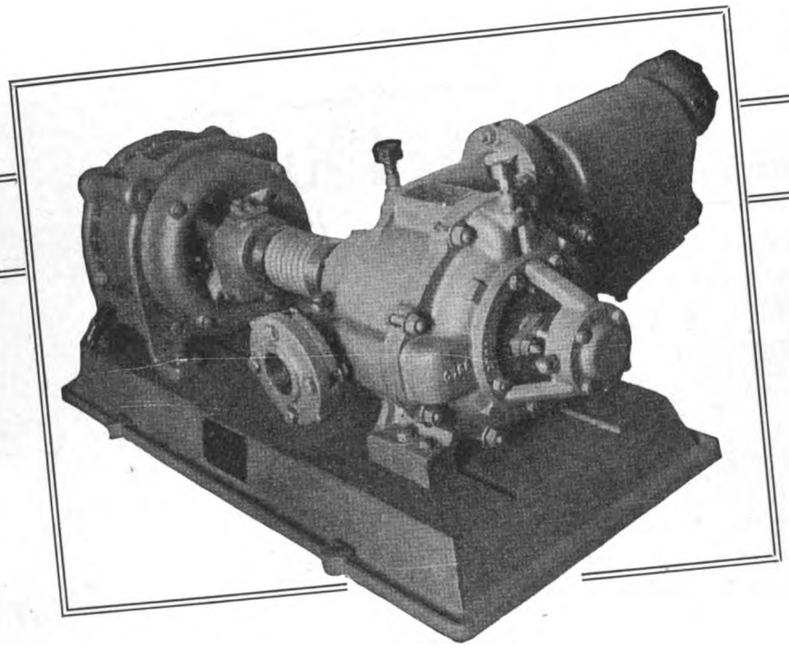
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Cross Section of Double-Row Bearing

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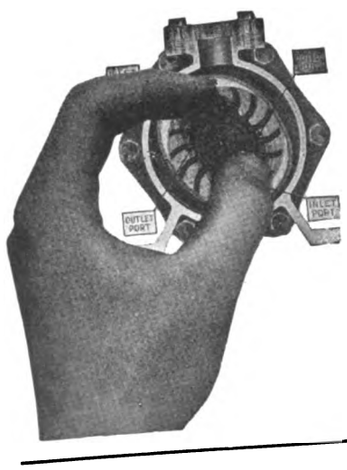


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The Pictorial Presentation of Practical Management

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Editorial

The New Emancipation

ON the 16th of May, 1792, King Christian VII of Denmark issued a royal order to the effect that the slave trade should be abolished in all Danish possessions from the end of the year 1802. This was the first link in a chain of events which culminated in the immortal Emancipation Proclamation of Abraham Lincoln, seventy-one years later.

In all the hundreds of years of recorded history previous to that time, human slavery was not only a part of the structure of civilization; it was a necessary part, without which the whole structure could not have been maintained.

It is but a brief handful of years—not quite sixty years, to be exact—since the Constitution of our country was amended to abolish and forever prohibit human slavery in the United States. There may still be an individual, here and there, who would like to see a return to that time-honored institution; but not even these few reactionary ones could bring forward any solid economic reason for their choice. And why?

Many men, in all ages—even back in ancient days—saw the evils and deplored the results of slavery. Men had begun to see more clearly, even before Denmark led the way. For taking the first step, all honor to that country and its statesmanship; for resolutely facing and clarifying and meeting the issue, all honor to our martyred Lincoln. But for *making possible* these great steps which removed a blot from civilization, the credit belongs elsewhere.

Until Watt, by his genius, converted an inefficient pump into a mechanism for converting steam into power, civilization could not have maintained itself without some form of slavery. Until other geniuses had carried on Watt's work—improved upon it, applied it to those tasks which had to be done, and which hitherto had been possible only through manpower—however much enlightened men might deplore that serfdom, they *could* not abolish it.

For thousands of years philosophers, statesmen, economists with all their best thought were unable to lift the yoke. And in a brief space of a little more than a century, mechanical genius has not only lifted that yoke, but has shown the way to an ever higher standard of civilization.

It is machinery, through applied mechanical genius—that holds the secret of low-cost production. And large scale production at low cost, this—and not any scheme or theory of government—is the key to the emancipation of the great mass of humanity.

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What Is the Best Type of Roof?

Factors of Major Importance in Industrial Roof Construction

By Walter F. Ballinger

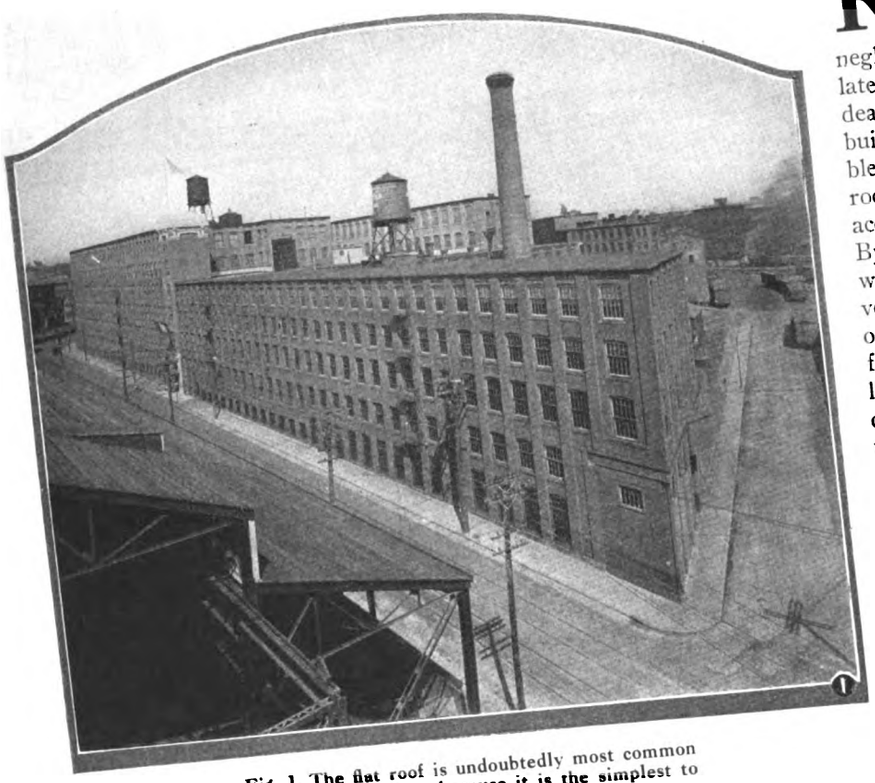
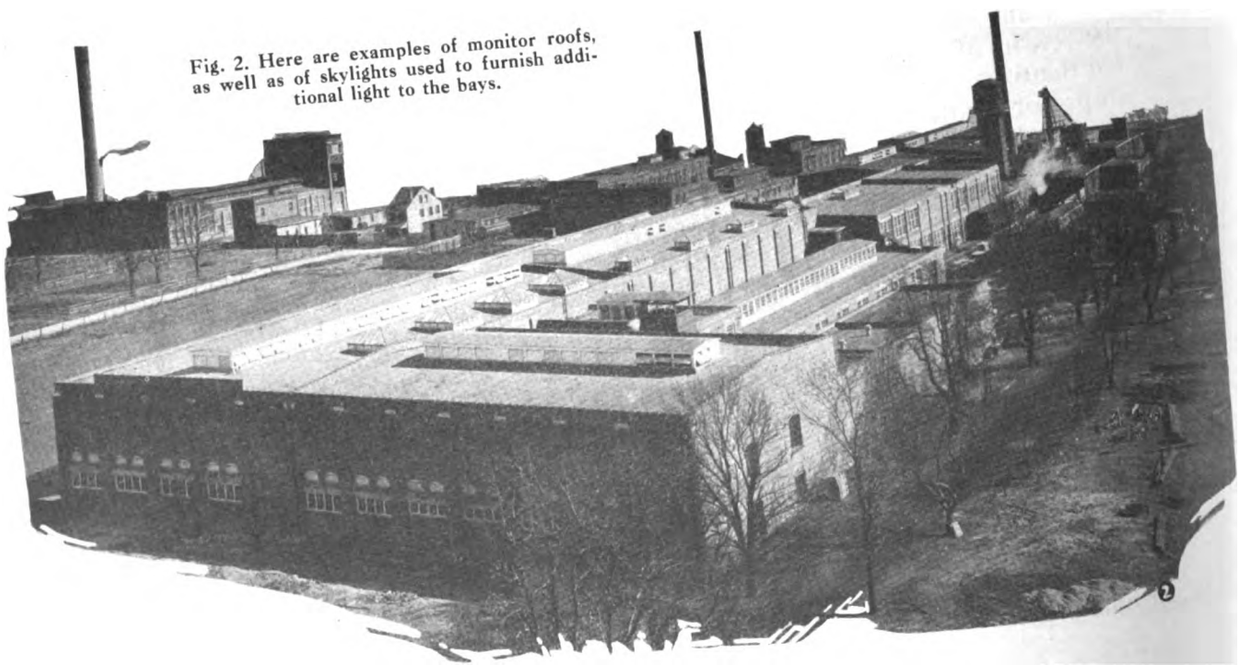


Fig. 1. The flat roof is undoubtedly most common in existing buildings because it is the simplest to build.

ROOFS for industrial buildings, often regarded as a necessary evil and often neglected both during design and later in maintenance, deserve a great deal of attention. In the design of a building of several stories, it is possible to carry out certain ideas with the roof structure that could not be accomplished with the lower floors. By eliminating columns, we can have wide spans, thus getting good natural ventilation, and with the proper kind of roof, large quantities of light uniformly distributed through skylights. Each style of roof is of course best suited to particular situations and special purposes and has its own peculiar advantages. Furthermore, if we take into consideration the foundation, the floors, the walls and the roof of a building, the most important of these is evidently the roof.

The best type of surface for a roof has an important bearing on the maintenance cost of the whole building. And right here attempts to save money by skimping the initial outlay on the roof will surely lead to large expenditures to maintain it as time goes on. Careful consideration

Fig. 2. Here are examples of monitor roofs, as well as of skylights used to furnish additional light to the bays.



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should be given to the type of roof to be put on an industrial building. Sometimes the cheapest roof to construct is hastily decided upon through neglect to consider the advantages offered by other types which, though costing more, would add considerable value to the finished building.

A flat or nearly flat roof carried by beams, girders and columns is the simplest type and one that is commonly used for industrial buildings because where the presence of columns in the working spaces is not an objectionable feature, it is about the cheapest to build and keep tight. It is usually built of wood or steel; sometimes of both these materials and gypsum or reinforced concrete are also used in many instances. Columns, sometimes closely spaced, must be used for support. In this connection, too, it may be stated that the only advantage for the top floor of a factory, as compared with the lower floors is that skylights and monitors may be put in the roof over it.

In many buildings it is essential to gain wider spaces between the columns supporting the roof and even to avoid using columns wherever possible. With this end in view, architects employ a truss, usually one or the other of two styles. One of these, the "A" type, gives to the roof a distinct pitch in two directions; the other, known as the "Howe" truss, makes a somewhat flat roof. The sawtooth roof, a comparatively new type, providing long spans without columns, will be mentioned later. All three have characteristic advantages

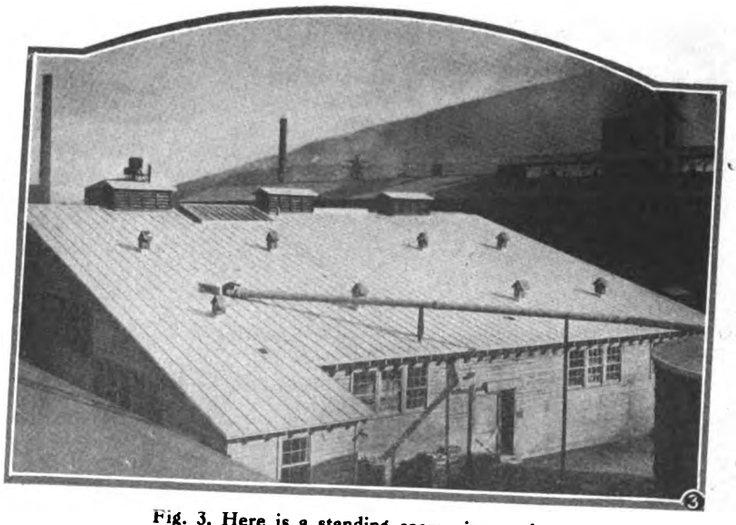


Fig. 3. Here is a standing seam zinc roof—a roofing frequently used for industrial buildings because of its weather-proof, non-rusting qualities.

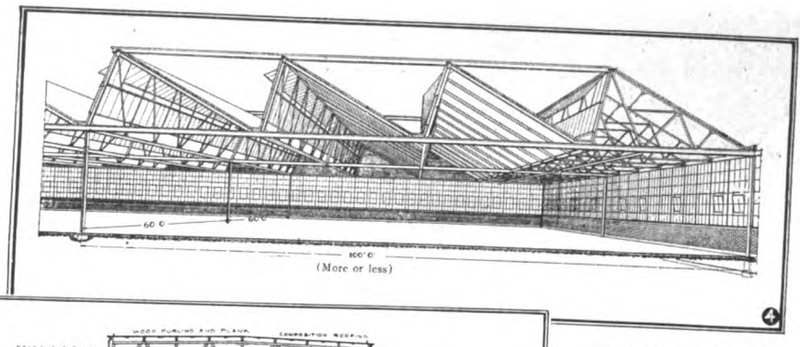


Fig. 4. This is how the "Super-Span" sawtooth roof construction eliminates columns on long spans.

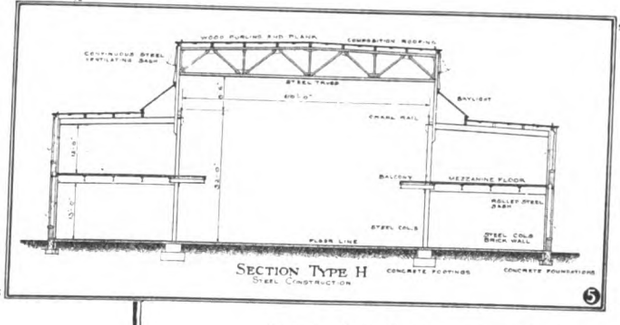


Fig. 5. Details of a type of monitor in common use for factory structures.

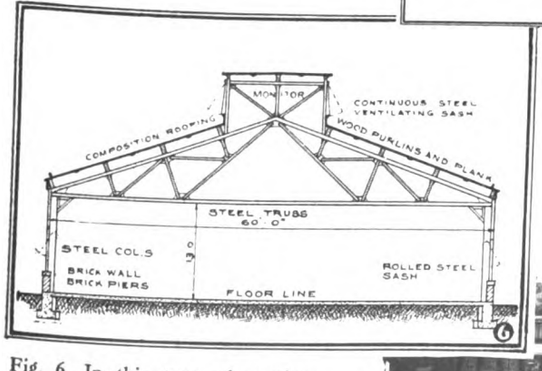
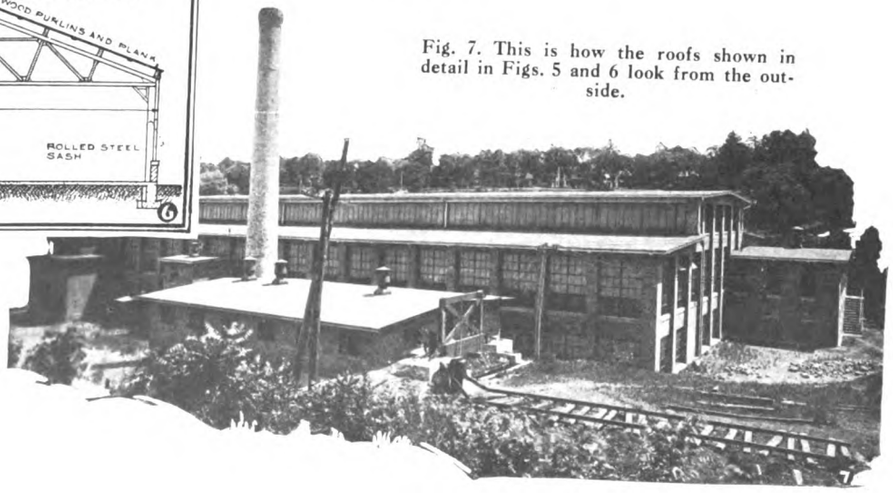


Fig. 6. In this type of monitor construction there is no need for vertical columns.

Fig. 7. This is how the roofs shown in detail in Figs. 5 and 6 look from the outside.



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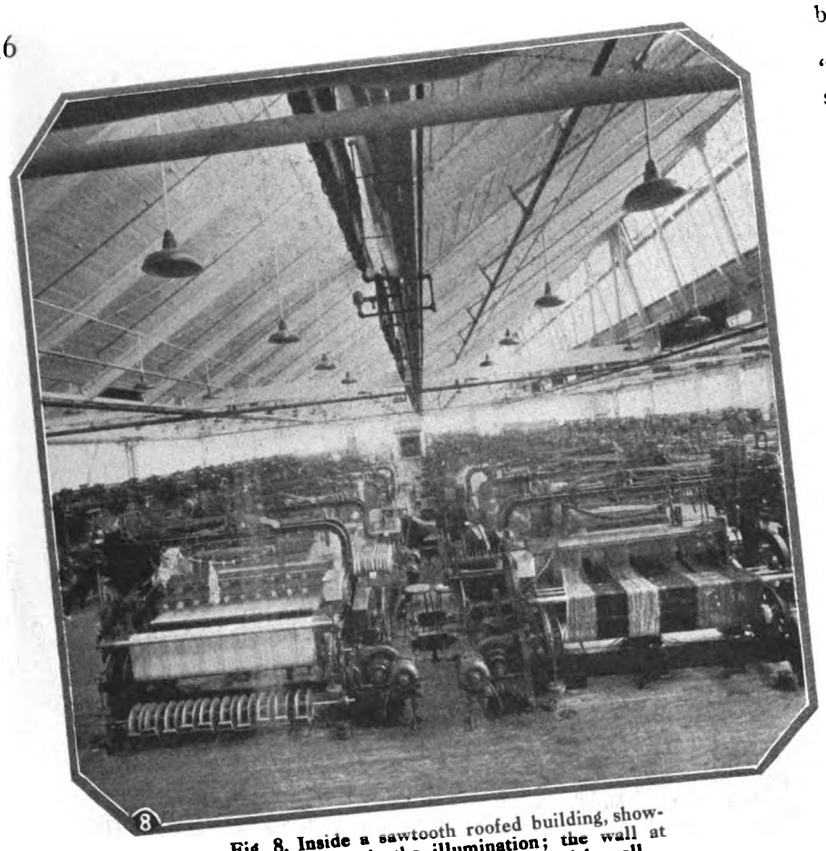


Fig. 8. Inside a sawtooth roofed building, showing how even is the illumination; the wall at the left, incidentally, is a solid brick wall.

best suited to particular conditions.

Considering the first mentioned, the "A" style truss roof, owing to its steep slope warm air and obnoxious fumes are readily disposed of as they easily move up towards the ridge from which they may pass out through monitors or ventilators built into the roof for that purpose. So they provide good natural ventilation if the escaping gases and fumes are lighter than air. For spans up to sixty feet and sometimes slightly more, the "A" truss roof is commonly employed. Surmounted by a monitor of some kind on the ridge for the purpose of light and ventilation, it is best suited for detached or individual buildings. Otherwise, if two or more such roofs were placed close together on the same building there would be deep valleys between, which would be objectionable on account of accumulation of snow as well as for other reasons.

In building a roof of this kind it is sometimes necessary to avoid the presence of any obstructions to the easy movement of ascending air currents, especially if the latter contain much moisture. Thus a purlin, if put in horizontally, will form a sort of pocket with the roof planks, which will surely obstruct the rising currents of moist air. The air thus caught would be likely to deposit its moisture by remaining in contact with the under side of the comparatively cool roof, and this condensation

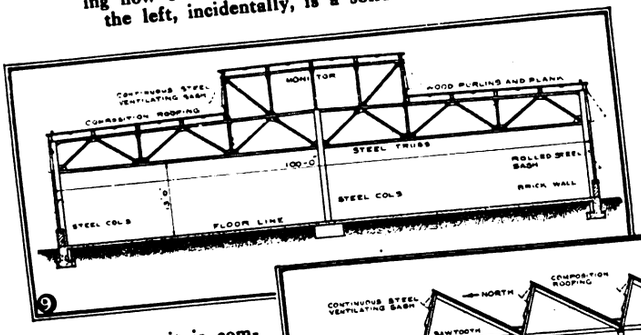


Fig. 9. For wide spans, it is common practice to use columns. These can be centered, as shown above.

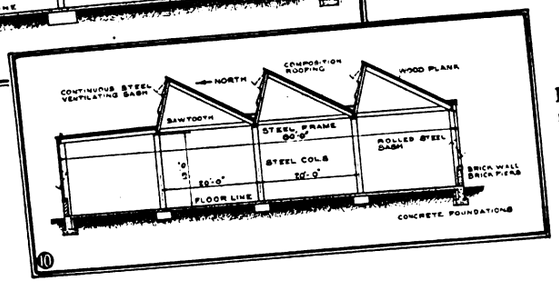


Fig. 10. The ordinary sawtooth roof requires vertical columns. Contrast this with Fig. 4.

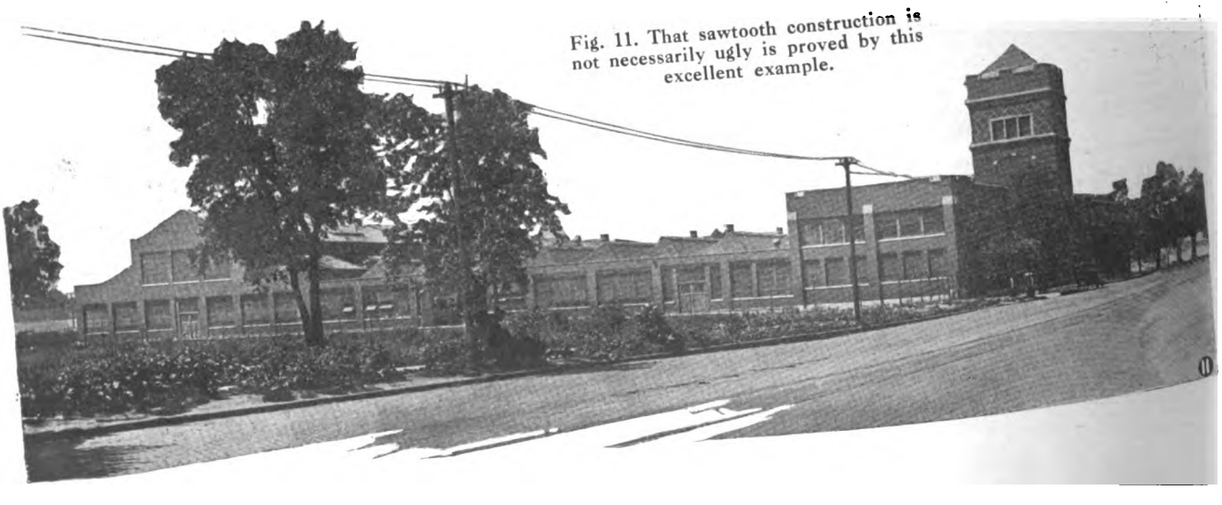


Fig. 11. That sawtooth construction is not necessarily ugly is proved by this excellent example.

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would drip down on anything below. Not only that, but the air, having cooled off, would then drop gradually out of the pocket and more warm, moist air would take its place. The repetition of this action can be prevented by construction that will allow the continuous rapid movement of the air to the outside atmosphere.

To avoid the valleys formed by "A" type trusses placed together, a flat or "Howe" truss may be used. For spans up to approximately eighty feet, some form of Howe truss is generally employed. Longer spans may be put in, provided the added cost is considered worth while. Flat trusses are adapted for roofs over very wide buildings if columns are put in and monitors and skylights built on the top to give the necessary illumination. The height of a Howe truss is about one-eighth of the span; thus an eighty-foot span would require a truss nearly ten feet high. For that matter, all flat trusses impose an additional height to the building at the eaves so as to get the truss above the clearance allowed for the lower chord.

This increases the cost of the building as well as the cost of heating an additional quantity of air, and in some cases for conditioning it.

There are many forms of monitors and they are used on flat roofs and pitched roofs indiscriminately. The usual monitor is built with two parallel, vertical rows of glass on each side of the ridge with a flat or pitched roof over them, according to the style of roof over which they are placed. Sometimes a monitor roof is built inverted to form a V-shape, the roof surfaces having a slope downward to the center, in order to facilitate ventilation by doing away with a pocket at the ridge. The windows are then located at the highest point of the monitor. Flat roofs are occasionally built pitched so as to drain in one direction and pro-

(*Continued on page 75*)

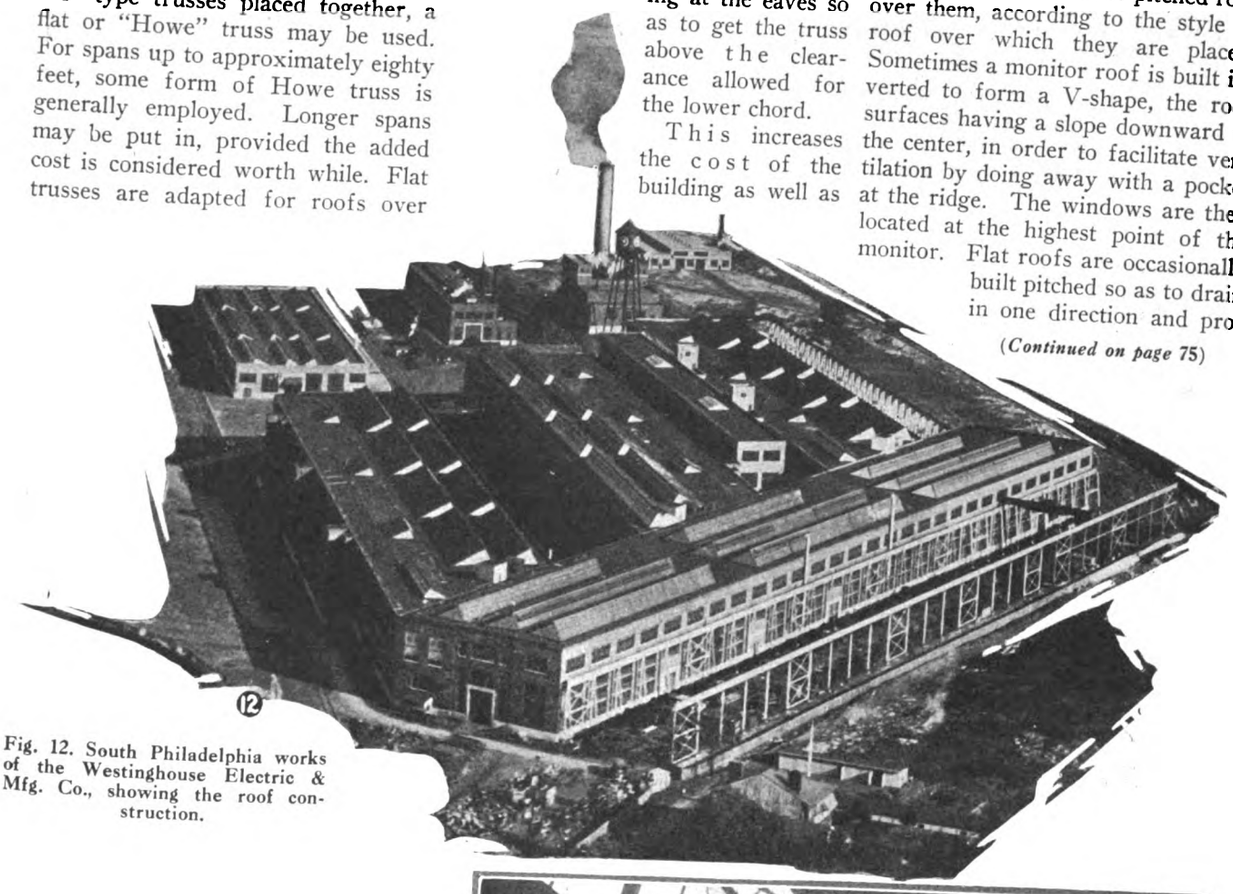
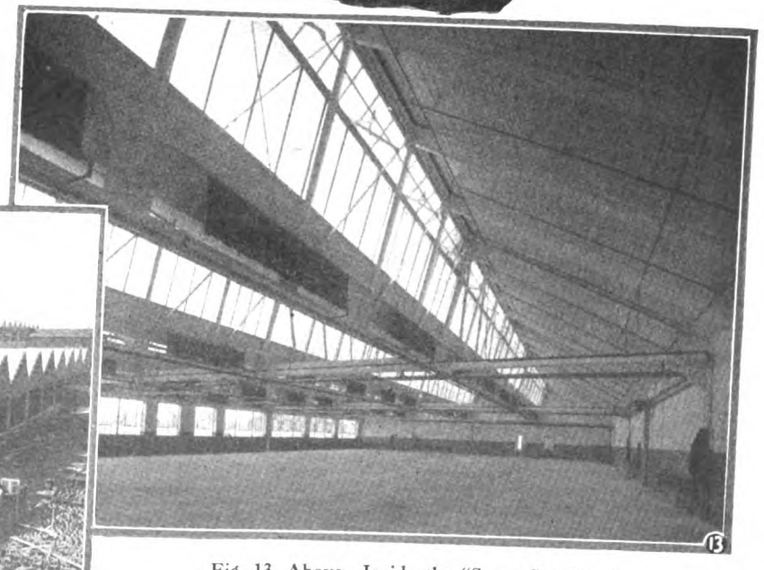


Fig. 12. South Philadelphia works of the Westinghouse Electric & Mfg. Co., showing the roof construction.

Fig. 14. Below—White surfaced roofing material on this sawtooth roof reflects the light into the building.



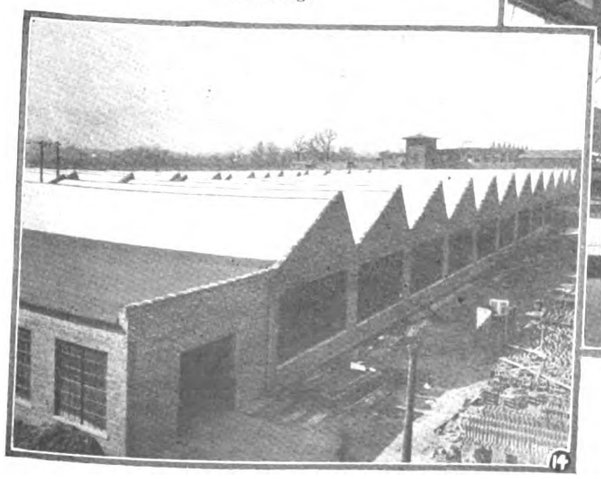


Fig. 13. Above—Inside the "Super-Span" sawtooth structure, showing the unbroken floor area and splendid natural light.

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The late Hugo Stinnes, industrial magnate and head of the Stinnes Konzern—an outstanding example of the vertical combination, comprising iron ore mines, coal mines, blast furnaces, rolling mills, steel plants, automobile plants, transportation companies, and even newspapers.

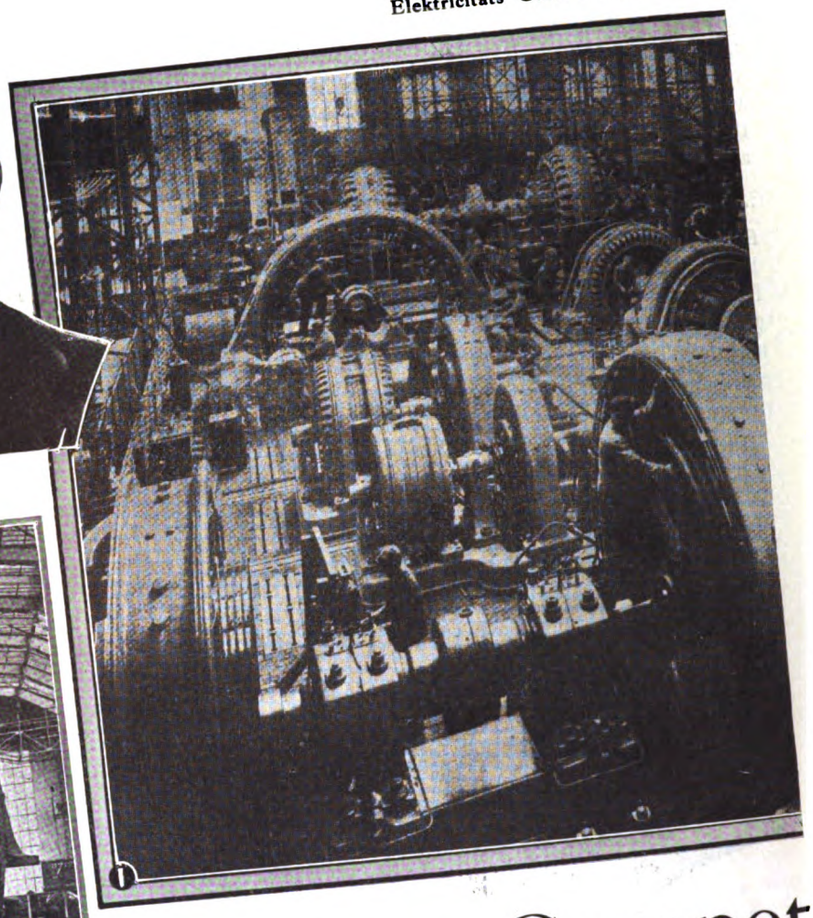


Fig. 1. One of the large machine plants of the A. E. G. (Allgemeine Elektricitäts Gesellschaft), of Ger-



Fig. 2. Part of a huge generator under construction at one of the A. E. G. plants.

Meeting Competitical Com

How the "Vertical Trust"

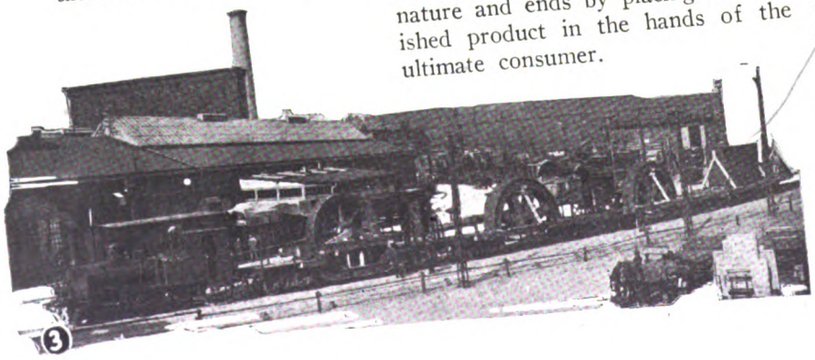
By Dwight T.

THE vertical trust is a consolidation of a number of industries of such a sort and in such a manner that the finished product of one is the raw material of the next. The complete vertical trust begins with the raw material as supplied by nature and ends by placing the finished product in the hands of the ultimate consumer.

The name vertical trust arose as a means of differentiation from the horizontal trust and the consolidation of allied industries which are the common forms of industrial consolidation in America. The horizontal trust is a consolidation of industries manufacturing a single product—as matches or automobiles. The consolidation of allied industries combines plants manufacturing articles of a similar nature, or which can be sold to the same market—as computing and tabulating machines and time clocks, or radiators and boilers.

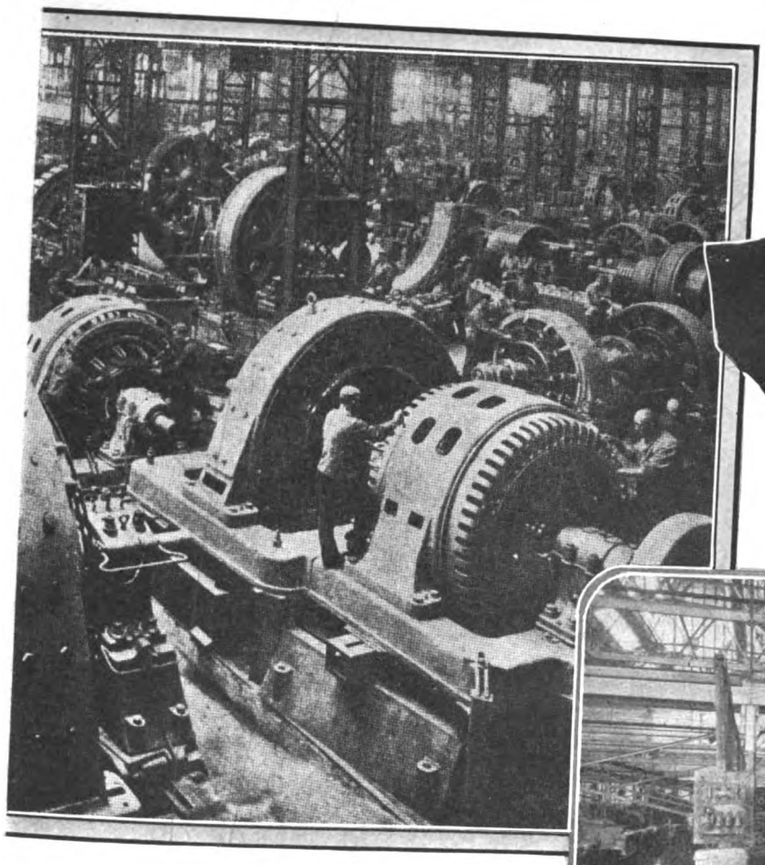
As nearly as I have been able to determine, the first vertical trust was conceived by Andrew Carnegie. Charles R. Flint, who is rightly called

Fig. 3. There is a striking similarity in this shipment from an A. E. G. plant to some of our views of the Schenectady plant shown elsewhere in this issue.



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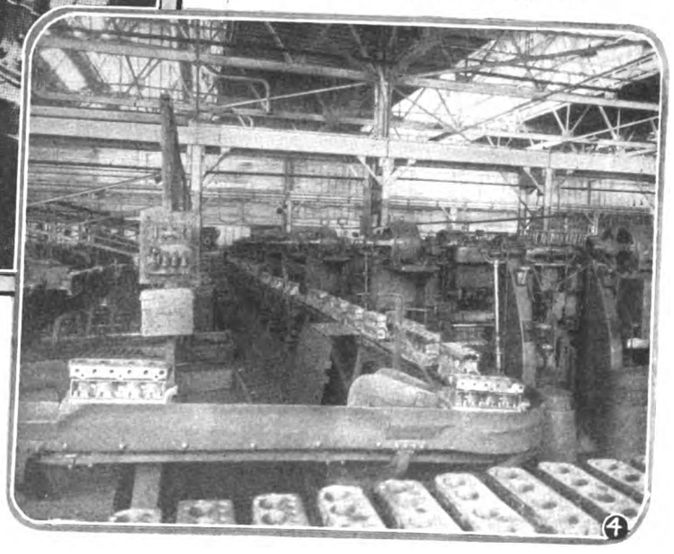
many; which is nearly as large as the Stinnes Konzern, but concerns itself with electrical products chiefly.





Henry Ford, whose company is one of the largest examples in this country of the tendency toward vertical combination. Starting as an automobile factory, this company has spread along the straight-line path forward toward the ultimate buyer, and back toward transportation and raw materials.

Fig. 4. The "moving production" idea, so highly developed by Ford, is being carried outside the factory to maintain a steady flow from mines to market.



ition by Ver-bination

Operates—and Why

Farnham

the Father of Trusts, having personally formed some twenty-one industrial consolidations told me the story at his Long Island country place in 1923*.

Carnegie had learned the vital lesson of the necessity for owning raw materials and finishing the completed article ready for its purpose. At this time he had Virginia ore mines and ironstone mines in Pennsylvania. He had purchased half of the Frick Coke Company which owned expensive mines of the best coking coal. He had built blast furnaces and he owned the Edgar Thompson Works which produced steel rails, the Homestead

Fig. 5. Large consolidations, such as the A. E. G., permit of the fullest use of labor saving equipment.



Fig. 6. Even though labor is far cheaper in Germany than here, yet the big plants realize what modern equipment means in materials handling.



*Note—See also Memories of an Active Life by Chas. R. Flint. (Putnams).

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Fig. 7. Apprentice schools are more highly developed abroad, and pride in craftsmanship is encouraged. These are some products from the A. E. G. schools.



Fig. 8. Metal scrap is deposited in basement bunkers, whence a magnet crane loads it into railway cars—at one of the A. E. G. plants.



Fig. 9. Motor and parts storage at a large German plant. Note the orderly layout and ready accessibility of parts.

Mills which manufactured miscellaneous steel shapes and he had purchased the Hartman Steel Company to work into various products the output of Homestead. In 1897 he was mining coal from some 42,000 acres of coal land, was turning out 18,000 tons of coke per day, 2,000,000 tons of pig iron per year and 6,000 tons of iron and steel per day.

When negotiations for the formation of the Steel Trust began a little later, those most active, knowing that Mr. Flint had been a colleague of Andrew Carnegie in the First International American Conference and had visited him in Scotland asked him to call on Carnegie and to ascertain if possible Carnegie's attitude toward the proposed consolidation.

Mr. Flint found Carnegie in his library where he talked very freely. He brought out blueprints and described his plants and his future plans in great detail. He showed how with such a vertical consolidation of mines, furnaces, plants and transportation facilities he could manufacture tubes more cheaply than the National Tube Co., structural steel more cheaply than the American Bridge Co., and wire at a lower cost than the American Steel & Wire Co. He discussed each section of steel manufacture at length and showed in detail how impossible it would be for existing corporations to compete with such a vertical consolidation. Finally he told Mr. Flint that he need not consider this information confidential.

In view of the fact that such a vertical trust would be invincible and that Carnegie was the one man in the United States who could make it effective, Mr. Flint's friends decided that the Carnegie plants must be acquired. The final result was the organization of the United States Steel Corporation.

In 1920 I found well de-

(*Continued on page 38*)

Fig. 10. Huge yard cranes over the railroad sidings at a modern German plant.

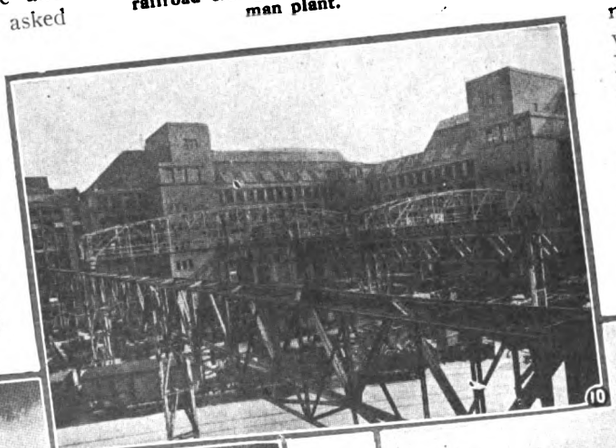




Fig. 11. Hospital facilities are a part of every modern plant, and this phase of modern management is well taken care of in the A. E. G.

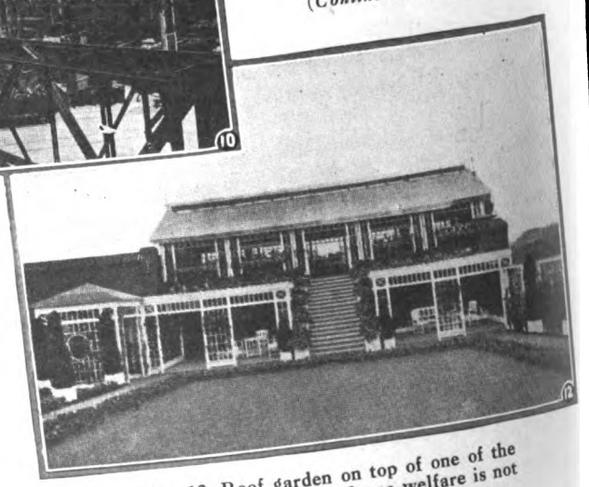


Fig. 12. Roof garden on top of one of the A. E. G. plants. Employee welfare is not lost sight of by these organizations.

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Keeping the Gear Teeth Quiet

By Allen F. Brewer

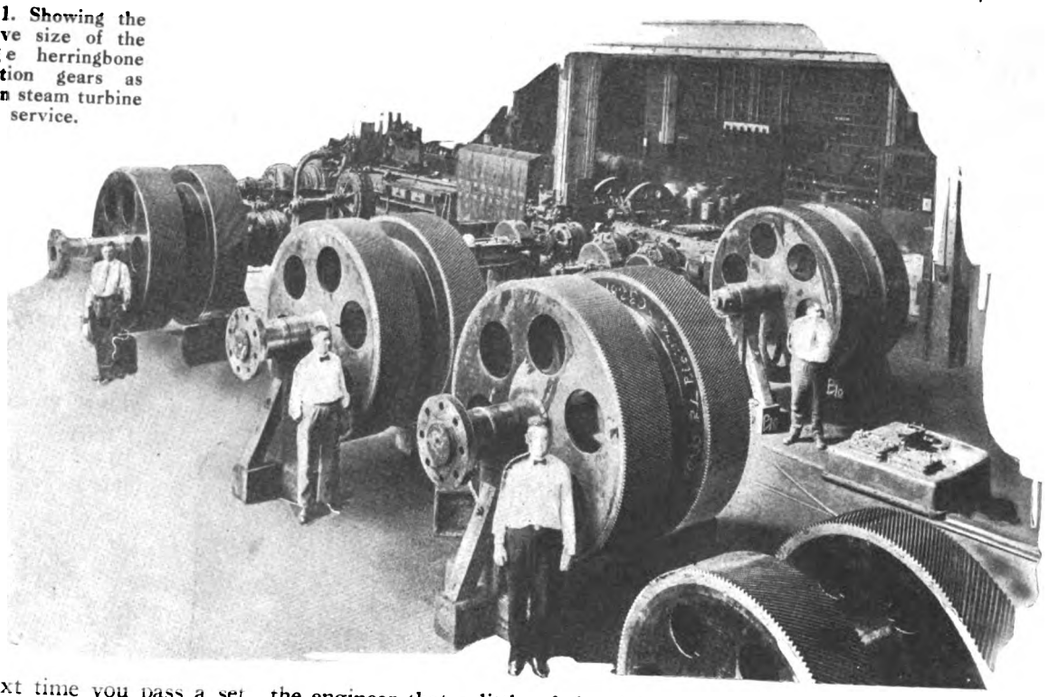


Fig. 1. Showing the relative size of the large herringbone reduction gears as used in steam turbine service.

THE next time you pass a set of gears which greets you with a vibrant clatter and clash as though they were endeavoring to simulate a blacksmith shop, pause a moment and consider the reason for this. Don't merely breathe a few complimentary (?) adjectives because perhaps your conversation has been interrupted. This won't cure a set of noisy gears,—one of the most objectionable and inefficient conditions that can be encountered in the modern industrial plant. Rather, tip off the engineer that a little of the right kind of lubrication is what his gears are gnashing their teeth about.

Lubrication, in fact, is the secret of efficient gear operation just as it is the keynote of mechanical efficiency everywhere else in the plant. The modern gear is a scientifically designed, carefully constructed mechanism, so accurate in shape as to mesh perfectly with its companion gear. Friction, however, cannot be eliminated with all our scientific efforts. Between all gears there must occur a certain amount of sliding and rolling friction as corresponding teeth engage or mesh. In proportion to the care exercised in their design and construction, the former will be reduced, though it can never be eliminated entirely. Pure rolling friction is in fact, a scientific ideal that is rarely attained in practice.

So we take the next best course and introduce a fluid or semi-fluid lubricant between the teeth as a partial solution to our problem. A further purpose which this lubricant serves is to eliminate noise. In fact noise is the harbinger of wear in gear operation, for it indicates imperfect meshing. The consequent repeated impacts resulting from this latter are the ultimate cause of the vibration

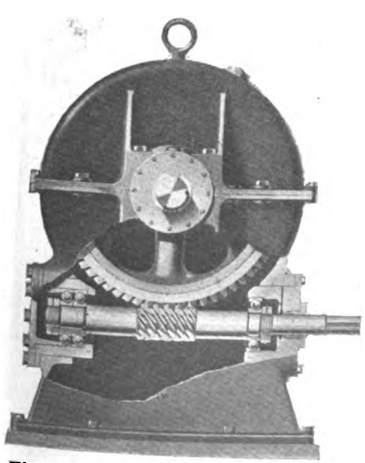
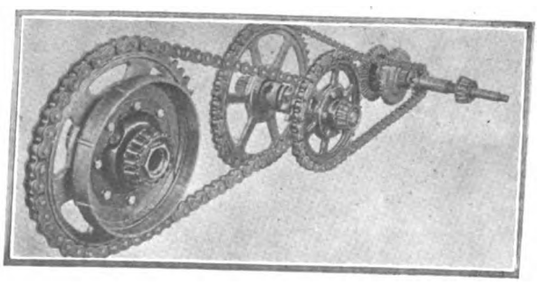


Fig. 2. Above—A worm and gear drive cut-away to show relation of gear teeth and ball bearings for thrust purposes on the worm shaft.

Fig. 3. Below—An arrangement of chain and bevel gears. Lubrication of such elements is important.



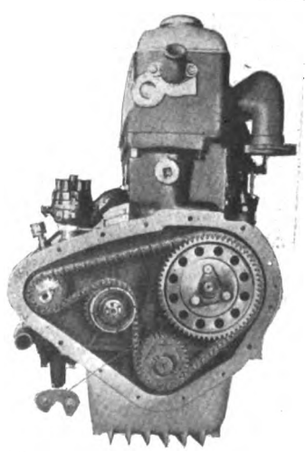


Fig. 4. Above—Silent chain and gear connection on the front end drive of an internal combustion engine. Such mechanisms are usually lubricated by the motor oil.

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and chattering with which we are all so familiar. Therefore, a noisy, rattling set of gears is an objectionable non-essential. To be true, gears operate under an extremely wide range of conditions. We have but to contrast the movement of our watch with the trains of gears involved in the modern steel rolling mill, to realize this. Some, for example, will be subjected to the extreme temperature conditions where either high heat is prevalent, or alternate heating and cooling is involved as perhaps in the rubber industry. Others may be exposed to hot water, acids or alkalis as in the steel mill. Still again, dust, dirt or other abrasive material may be so prevalent as to render protection of the gear teeth practically impossible. All these conditions may result in rusting, corrosion and alteration of the shape of the gears to such an extent that effective operation will be hampered by excessive vibration and rattling. The use of a heavier grade of gear compound will sometimes counteract this, if wear has not progressed too far, but it must be the right sort of lubricant otherwise it will serve as but a temporary remedy.

The progressive manager, superintendent and engineer today fully realizes the importance of gear lubrication. In fact, the companion result—gear preservation, is one of the most vital factors with which they will have to deal. Expense of gear replacements, the delays involved with subsequent loss in production, and the added skilled labor that must usually be kept on hand in event of gear breakdowns, entails monetary losses which are distinctly non-essential, and under ordinary conditions, capable of ready reduction by simply a little more care and attention to lubrication. Lack of lubrication or the use of some waste or cheap oil or grease product are the paramount reasons for the above losses, and the resultant possibility of rusting, abnormal wear, corrosion, stripping and breaking of teeth, etc. It is surprising, the extent to which power can be unnecessarily wasted due simply to neglect, and lack of appreciation that gears are quite as accurately designed and machined as are the bearings, slides or cams which are so extensively involved in the average machine. Faulty gear operation or breakdowns due to stripped teeth, will involve even more difficulty than will an over-heated bearing or a worn cam, due to the fact that entire replacement of at least one gear will often be necessary, and gear replacement involves an indefinite period of shutdown unless spares are customarily kept on hand. Therefore gear lubrication is quite as important a problem as any other phase of industrial plant lubrication.

Gears serve four distinct purposes in the capacity of eliminating slippage or loss of power such as might occur with other methods of power transmission involving friction wheels, belts or rope drives, and they are:

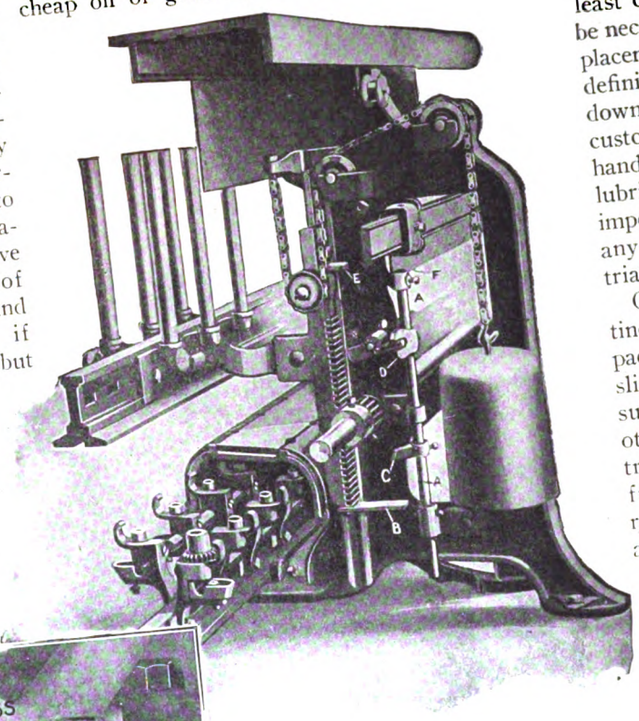


Fig. 8. Below—Top view of a tractor transmission, showing the numerous gears employed. Gear lubrication on the tractor is an important factor.

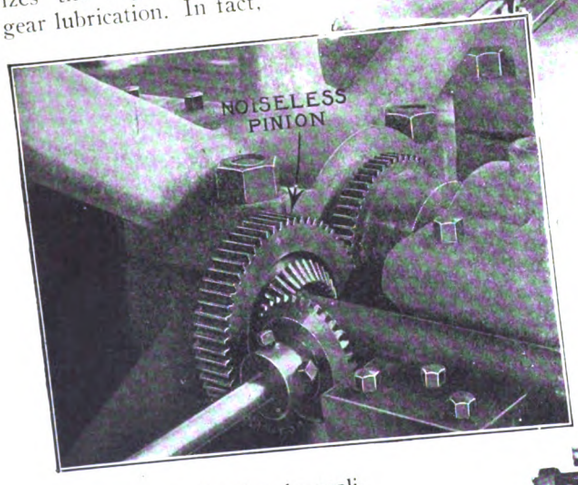


Fig. 6. Above—Showing the application of the noiseless pinion to the governor-driving mechanism of a gas engine. Silent operation is a feature in such a device.

Fig. 5. Above—Rack and pinion as used on a safety stop motion of a textile machine.

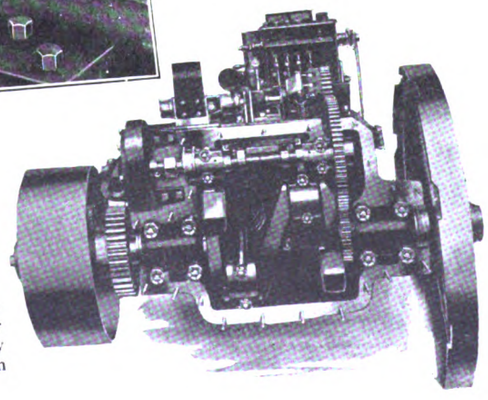
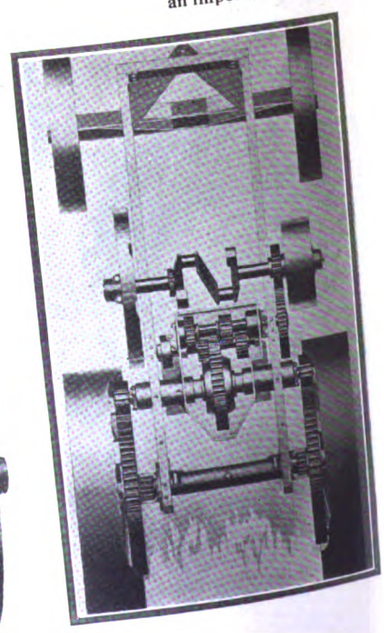


Fig. 7. At the right—A tractor engine exposed, showing the spur gear mechanisms installed. Gears play an important part in the modern tractor.



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1. To transmit power.
2. For the changing of speeds.
3. In changing the direction of rotation of any particular part, and
4. To change the point of application of the power which is being transmitted.

While the transmission of power by means of gears in theory involves purely rolling motion between the surfaces of the gear teeth, in practice there will always occur a certain amount of sliding motion as well, especially as the teeth engage and pass out of mesh. Sliding motion imposes considerably more wear on the surfaces in contact than does rolling motion. For this reason, it is wrong to regard gear lubrication as of relatively minor consequence: no surfaces will wear more rapidly than two which are in sliding contact. Therefore, since friction of this nature will depend on the accuracy of design and construction, the alignment of shafting and the freedom and smoothness with which the gear teeth engage or mesh, it is natural to assume that wear will occur in like proportion. Of course, the essence of efficient gear operation is to have the gear teeth roll so smoothly into each other, with such a constant relation in velocity between the two wheels and their corresponding shafts, that friction is reduced to a minimum. The lubricant in such a case will serve to equal extent in the reduction of noise and vibration and in the prevention of undue friction and wear. In other words, the efficiency of any type of gear drive will depend upon the extent to which friction and wear is overcome by means of correct design, proper construction and careful lubrication. The advantages of efficient gear lubrication which will result are:

1. Noiseless operation.
2. Minimum vibration and shock between the teeth.
3. A minimum of wear with a corresponding increase in the life of the gears,
4. Therefore, less wear on all adjacent operating parts which are affected by the rolling of the gears, and
5. Maintenance of gears at their designed strength and capacity for work throughout their life.

Gears will vary in design, principle of operation and their manner of construction. As a result, the term "gearing" is broadly extended by many to cover any form of friction, chain

(*Continued on page* 55)

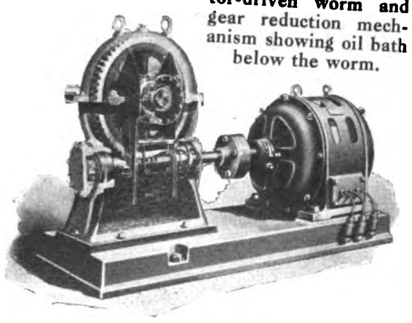


Fig. 9. Below—A motor-driven worm and gear reduction mechanism showing oil bath below the worm.

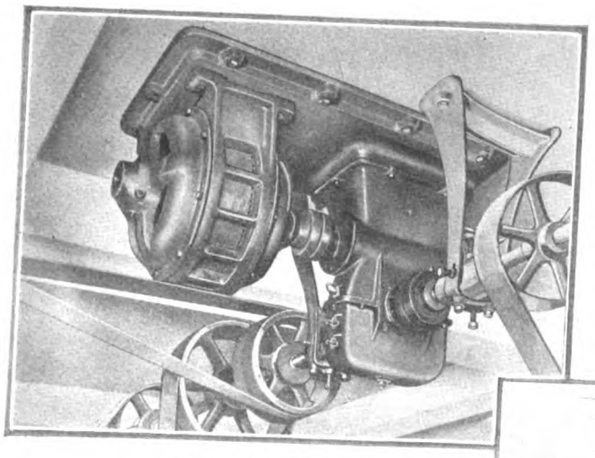


Fig. 10. Above—Illustration of a motor-driven worm reduction geared line shaft drive. A special housing provides lubricant for the gears.

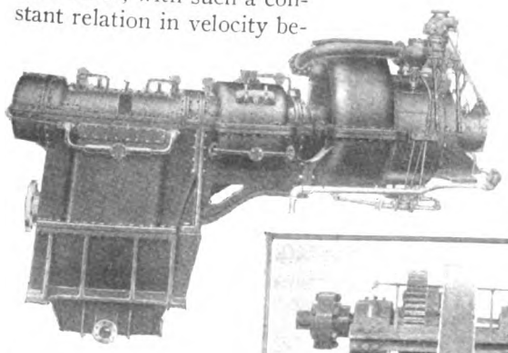


Fig. 11. Above—Turbine reduction gears as used in connection with large turbine units, fully housed.

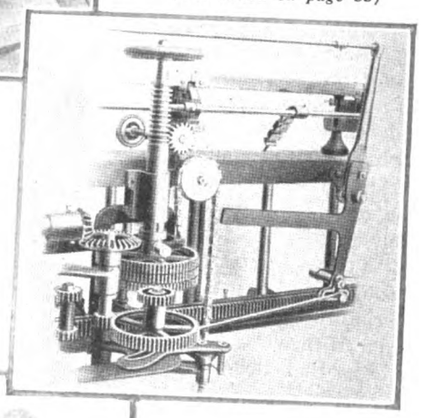


Fig. 12. Above—Showing spur and bevel gearing, as well as rack and pinion arrangement on a tension regulator of a (textile) roving machine.

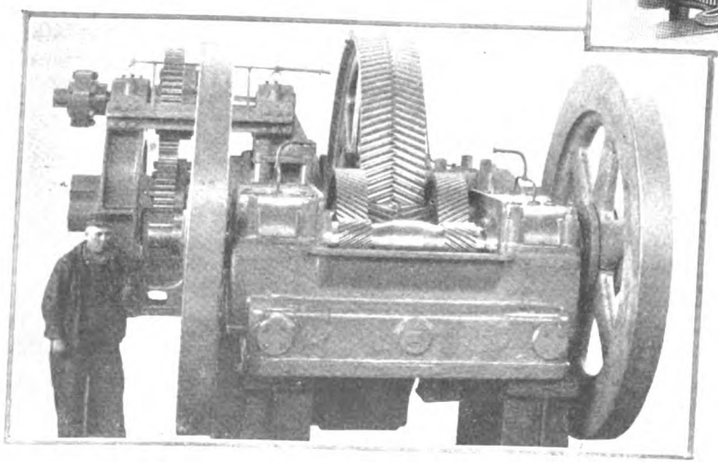


Fig. 13. Arrangement of herringbone reduction gears. Note, also, spur gears to left. Forced lubrication is often employed on large gears of this type.

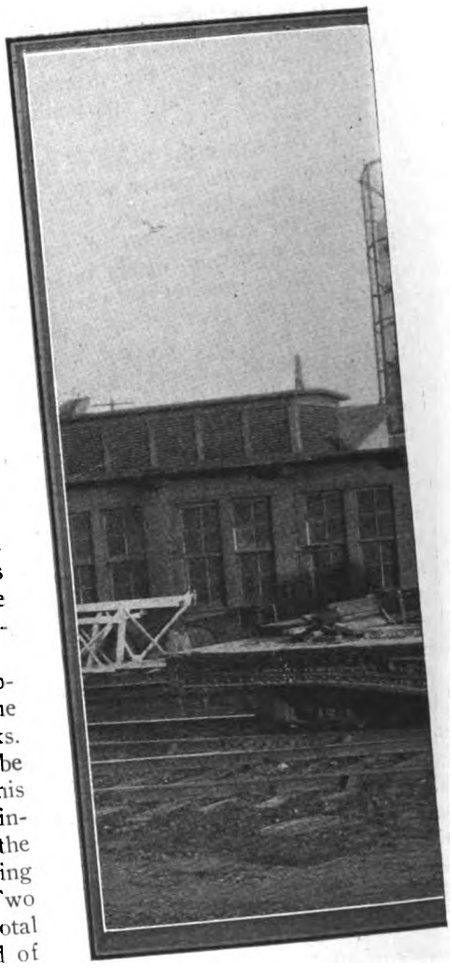
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How They Solve Their Packing and Shipping Problems

By John H. Van Deventer

THE name of the Shipping Department of the General Electric Company at Schenectady does not fully describe the functions embraced by this unit's activities. This will become readily apparent when it is learned that these functions include, mainly, (1) the maintaining of a stock of complete units of finished product for application on customers' orders; (2) packing material preparatory to stocking or shipment; (3) the assembling from different manufacturing sections, of finished products, preparatory to the final shipment to customer, and (4) actual shipment from the plant of material destined for customers or other plants and warehouses of the General Electric Company.

The principal unit of the shipping department is located in a main warehouse and despatching point, building No. 50 situated in almost the geographical center of the plant and there are also eighteen subsidiary packing rooms, shipping points and warehouses, distributed at strategic points throughout the plant, special thought being given to their location in order that they may be near points where manufacture of apparatus is completed. The total floor space amounts to nearly 350,000 square feet, including buildings, sheds and covered platforms. About fifty per cent of this space is used in storing warehouse stocks. The loading facilities permit the simultaneous loading of 97 freight cars, of which the main shipping building can accommodate 36. The average number of employes usually required to accomplish these functions is about 500, including office and factory help.



In and adjacent to the main shipping building No. 50 are nearly one mile of narrow gauge railroad tracks. Of the 36 cars which can be loaded from the platforms of this building, 6 are taken care of indoors and the remaining 30 on the outdoor tracks—the car floors being flush with all loading platforms. Two standard gauge tracks with a total of 280 ft. enter the southern end of the building and three narrow gauge tracks run practically the whole length of the building on the first floor. There are ten turntables to accommodate the crisscross tracks which run at right angles with the main tracks. One of these tracks runs through three of the 14,000 lb. freight elevators, and loaded narrow gauge freight cars are taken to the upper stories. Here, by means of still other turntables, the cars can be run to all parts of the floors. Each freight elevator can accommodate one narrow gauge car. Among other materials, one of these freight elevators handles the 20 to 30 tons of excelsior used in the factory every day.



Fig. 1. Stock of standard goods in standard quantity packages in the stockroom, showing the "directory card" on each end of a pile.

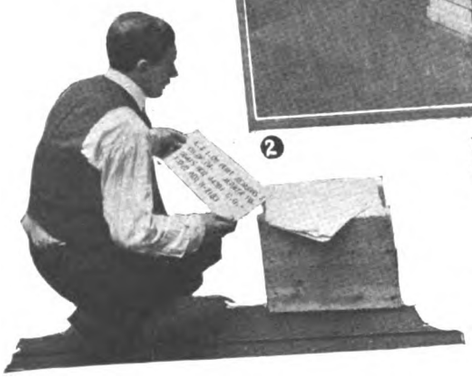


Fig. 2. Checking stencil against requisition, in the shipping department.

For the heavy lifting there are 25 electric cranes, including an outdoor gantry crane running on rails 50 ft. apart. Its operating radius is, however, greater, due to a 15 ft. overhang. This crane can lift a narrow gauge car off its rails and deposit it on the narrow gauge tracks leading into the side of the building, so loaded cars can be brought into the building without entering by the

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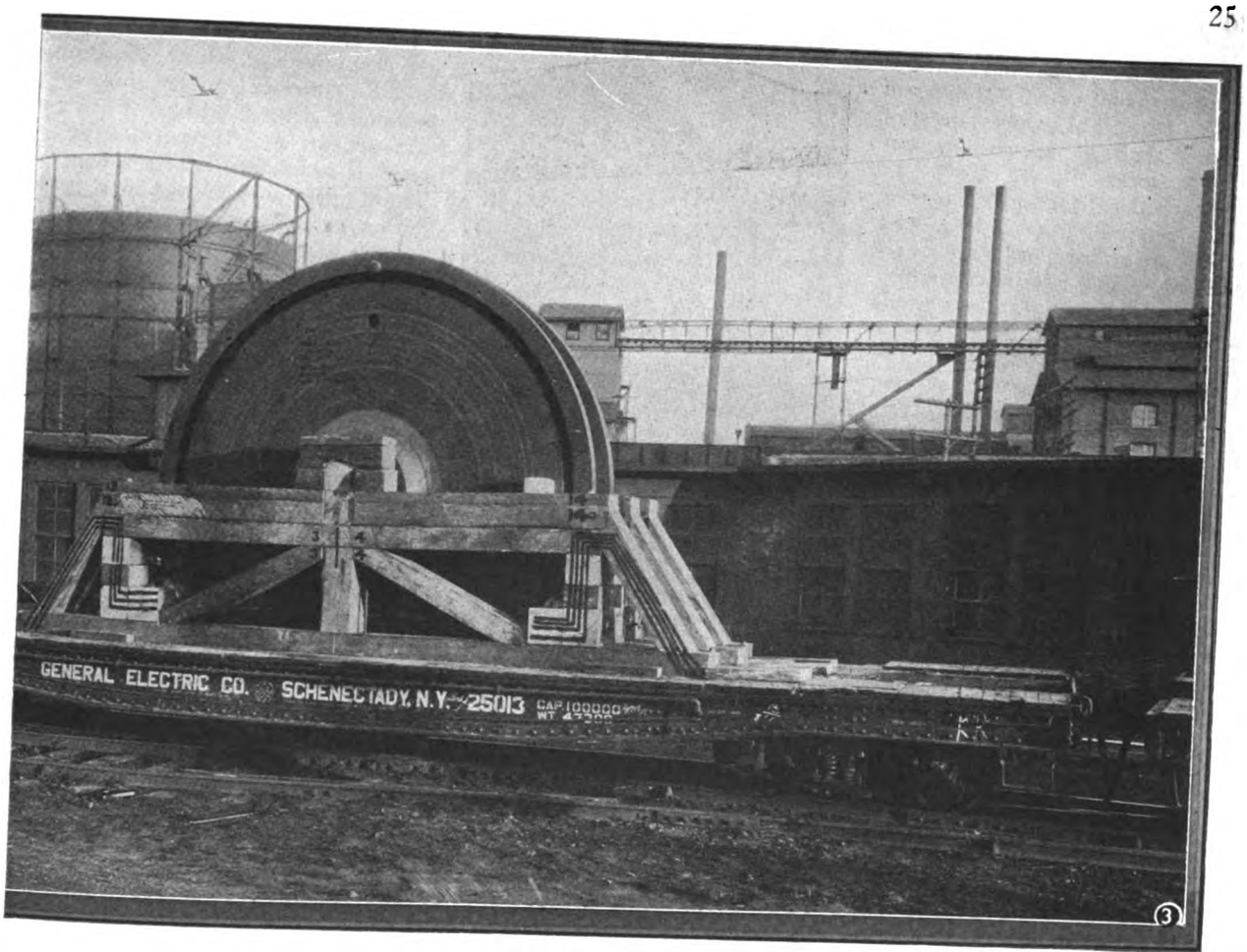


Fig. 3. Two outside sections of a huge flywheel, as blocked and braced for export shipment.

regular tracks at the end. The electric cranes, 25 in number, carry from 30 tons down to one ton. The smaller ones are called rope cranes and are operated by the men handling the boxes.

A card index is kept in the Shipping Department showing the serial numbers and specifications of all induction motors ever sold by the General Electric Company. The value of this lies in the fact that a customer merely has to give the serial number of his motor to enable the shipping department to send him spare parts, in spite of the fact that his motor might have been sold him many years before.

As a matter of fact, a large portion of the orders received by the General Electric Company can be filled from warehouse stocks similar to the one



Fig. 4. Nearly 1,000 questions are handled daily by the shipping department information bureau.

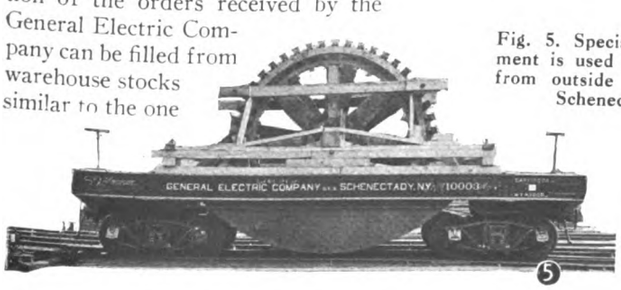
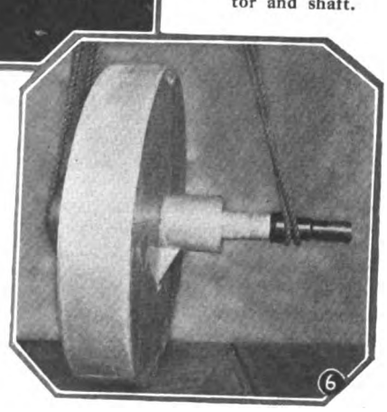


Fig. 5. Special railway equipment is used for large castings from outside foundries to the Schenectady plant.

Fig. 6. Below—A zinc cylinder covering for export shipment of rotor and shaft.



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maintained in this building. At this particular point over 5,000 different kinds of electrical supplies—most of them in standard packages—are carried in stock.

Requisitions for stock material, when received from district sales offices, are accompanied by four carbon copies, and a manifest is then made out listing the various requisitions received. This manifest is used for record purposes. The orders are then separated into two classes; express and small orders and freight and parcel post orders. The freight orders are then routed and parcel post zones stamped on. All orders are then assigned by a Requisition Distributor to the proper shipping sections, of which there are thirty. The orders are then passed to a girl for card-indexing. On this record is shown the number of the requisition, the name of the office from which it came, the date received, the method of shipment and the number of the shipping section or clerk to which the order is assigned. An "Information Bureau" is maintained, where a number of girls answer telephone inquiries on any orders. This they are able to do by means of the cards referred to, kept up to date as to the status of the order up to the time it is shipped to the outside.

To return to the requisition, it next is passed to the stock record clerk who makes proper entry on stock cards and determines whether or not the material is available for shipment from warehouse stock. In the event that it is, the order is delivered direct to the stockroom where the boxed apparatus is selected, stenciled and loaded on outgoing cars.

After the stock clerk has finished with the order, it is sent to a typist in the main shipping

(*Continued on page* 86)



Fig. 7. Crane lifting an empty narrow gauge freight car.

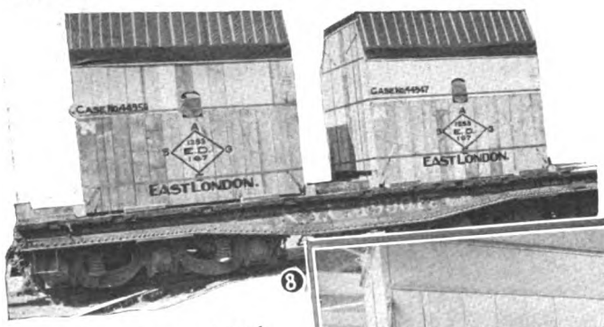


Fig. 8. Armatures, boxed and on car, for shipment to South Africa.

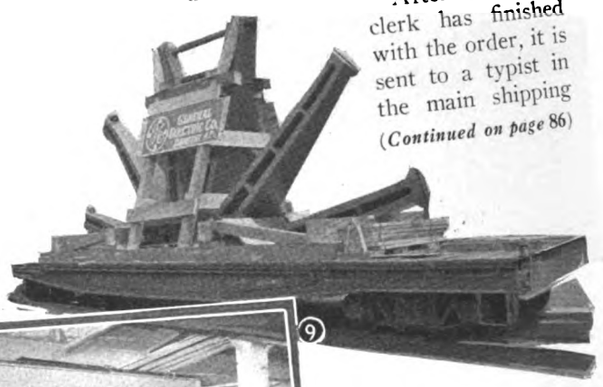


Fig. 9. One half of a rotor spider; a clumsy unit to make secure for shipment.

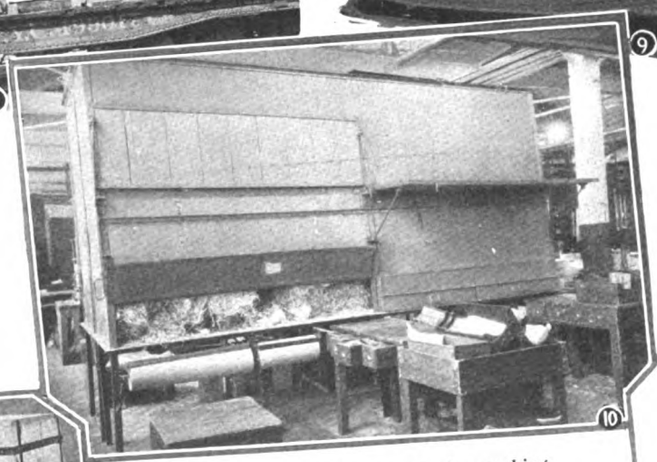


Fig. 10. The equipment in the packing department is not only ultra modern, but is arranged to expedite the work.

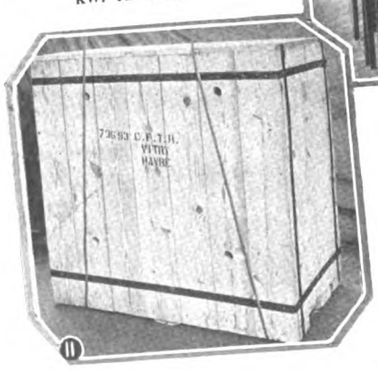


Fig. 11. Below — Export packing of an oil tank and turbine standard of 12,500 kw. turbine.

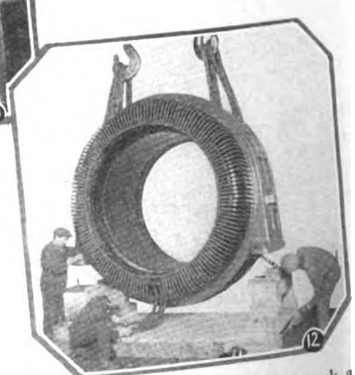


Fig. 12. Preparing to pack a large stationary armature for export shipment.

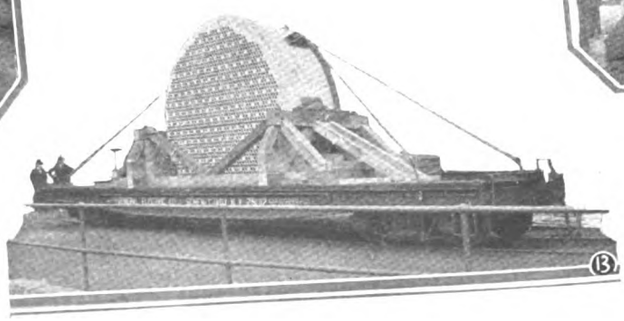


Fig. 13. At the right—Domestic shipment of mercury boiler, to Hartford, Conn.

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Trucks Destined to Create a Mileage Record

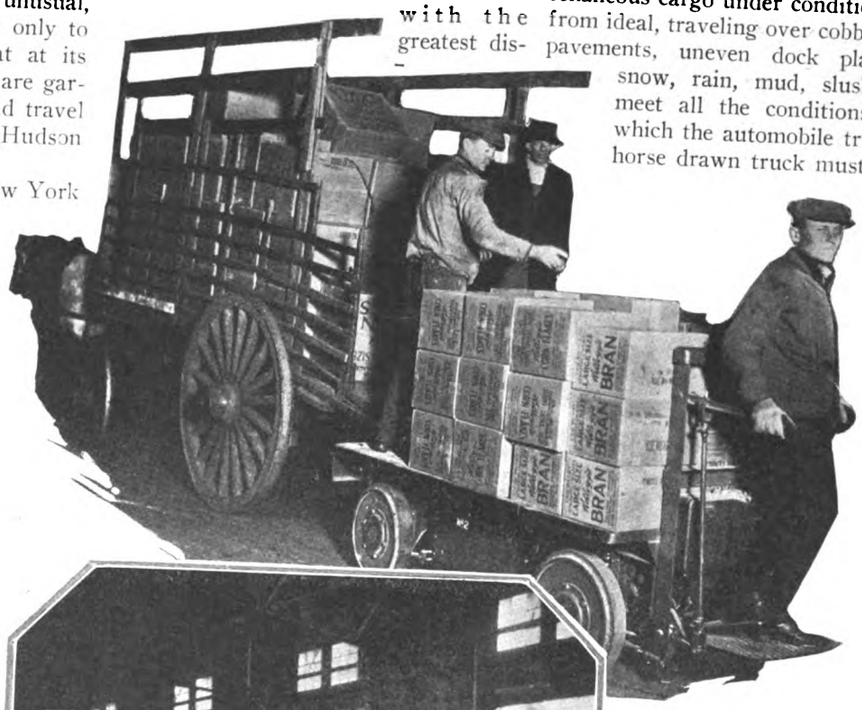
By F. C. Eibell

THE two electric industrial trucks shown here were recently installed on one of the freight carrying boats of the Central Hudson S. S. Company of New York City. Their application is unusual, in that they are used not only to load and unload the boat at its New York pier, but they are garaged on board the ship and travel with it up and down the Hudson River.

The boat is loaded in New York City with between 700 and 800 tons of freight by the two high platform electric trucks and all freight must be on board before 4 P. M. Four stops are made on its trip up the Hudson—Newburgh, Beacon, Poughkeepsie, and Kingston—at each of these places the two trucks unload the freight and pick up cargoes destined for the stopping places along the route.

During the trip from New York City to Newburgh, and on the runs between Newburgh, Beacon, Poughkeepsie, and Kingston, the trucks are connected to the charging panel which has been installed on board the ship, and their batteries are kept well charged by this arrangement.

Plenty of work is the rule for these trucks, for they must handle the work on and off of the boat with the greatest dispatch. It should be noted that the trucks must climb a steep ramp at times due to the condition of the tide, that they must handle a miscellaneous cargo under conditions far from ideal, traveling over cobblestone pavements, uneven dock planking, snow, rain, mud, slush, and meet all the conditions with which the automobile truck or horse drawn truck must cope.



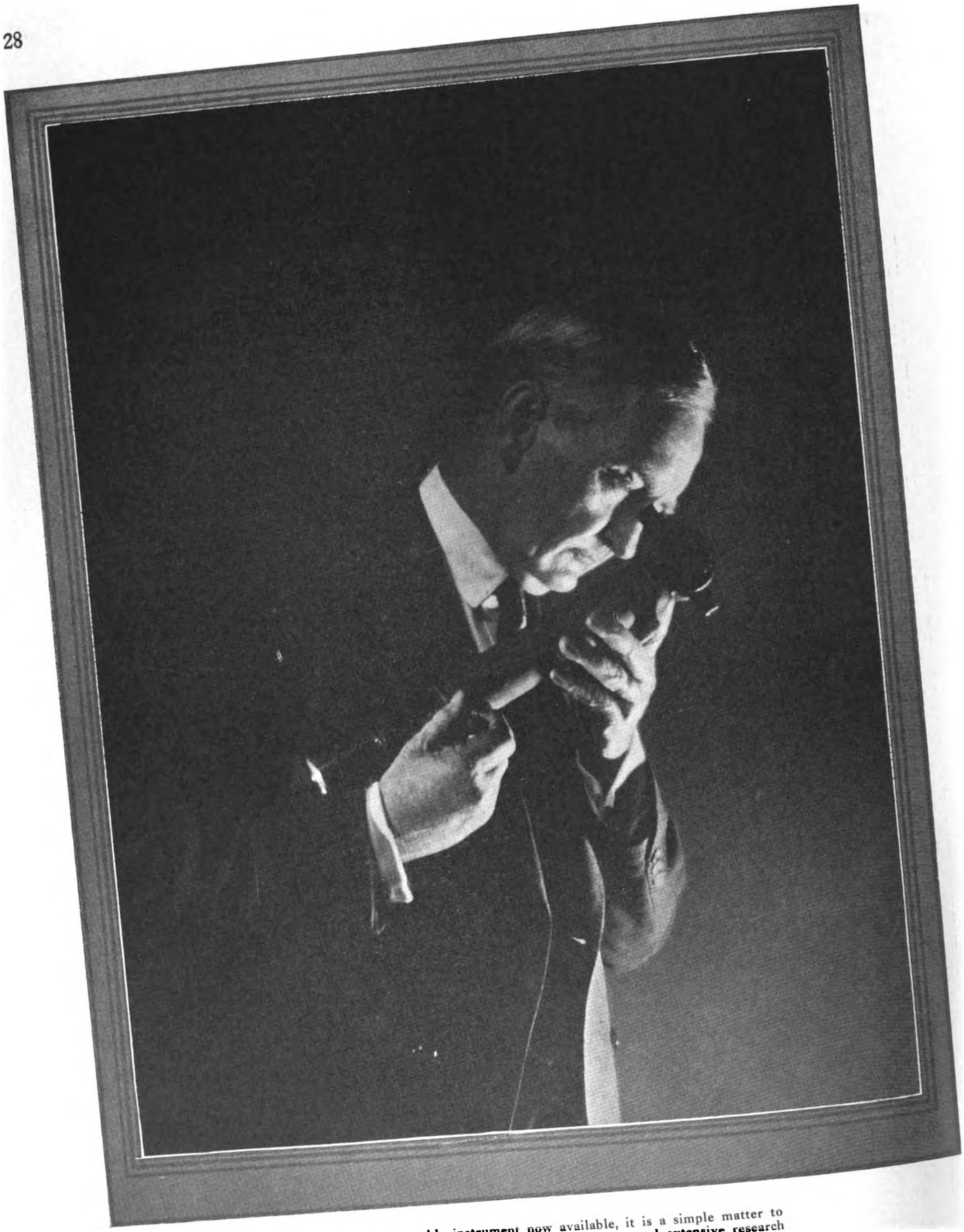






Figs. 1, 2, 3, 4. These two trucks, shown in the four illustrations on this page, probably travel further than any other pair of storage battery trucks—though not on their own power!

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By means of a portable instrument now available, it is a simple matter to determine the intensity of illumination of any area; and extensive research has developed a table of intensities which have been found best for specific purposes.

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Maintaining the Electric Lighting System

How Proper Maintenance Affects the Lighting Bills

By William G. Ziegler

GOOD artificial lighting is being given more and more attention, of late years, due to the fact that most managers realize that it increases production. If a plant is not properly lighted it is safe to assume that an increase of from ten to twelve per cent. in production may be counted on by installing a correct lighting system, and the operating cost of this system is usually only about two per cent. of the payroll. The effect of proper lighting on the workmen is another very important point, for they are sure to be more contented in a well lighted plant. Proper lighting also tends to reduce spoiled work because the men can see better, and in some cases this may amount to twenty-five per cent. less spoilage with correct illumination. The records of accidents also show that about twenty-five per cent. fewer accidents occur when correct lighting is in effect. Some states have adopted lighting codes, as they have recognized the fact that good lighting has a tendency to make plants safer for the men. The men are more cheerful in well lighted plants and this is reflected in their better health. The codes usually specify the minimum intensities allowed for the various operations and also suggest higher intensities which are desirable. The intensities recommended now by competent engineers are almost double those of five or six years ago because the high peak of war production showed that intensities much higher than ordinarily used were largely instrumental in getting out more than normal output.

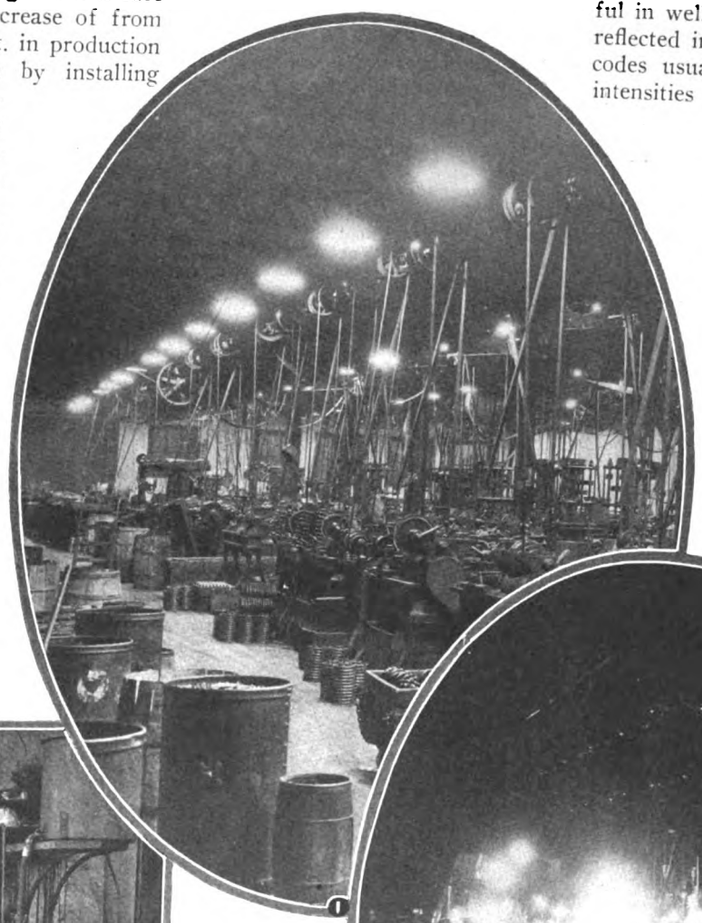


Fig. 1. Even, shadowless light is the important factor. Contrast this with Fig. 2, which shows the same shop under former conditions.

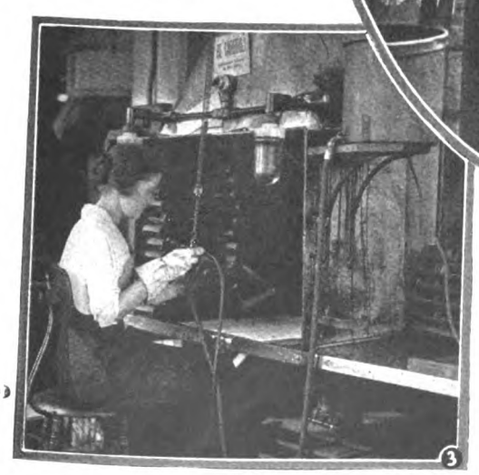


Fig. 3. Explosive fumes require a fully enclosed lamp, which may be installed as close to the work as necessary.

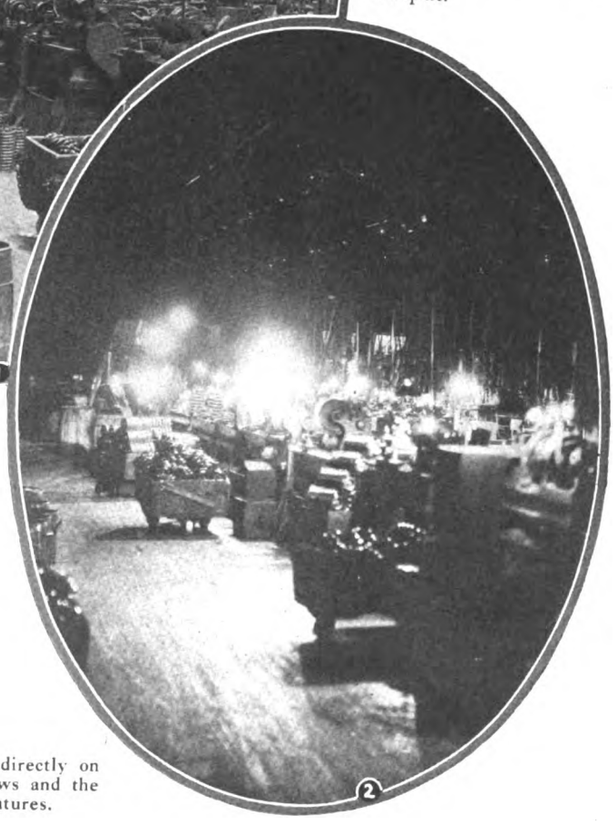


Fig. 2. With plenty of light directly on the work, yet the deep shadows and the eye-level glare are bad features.

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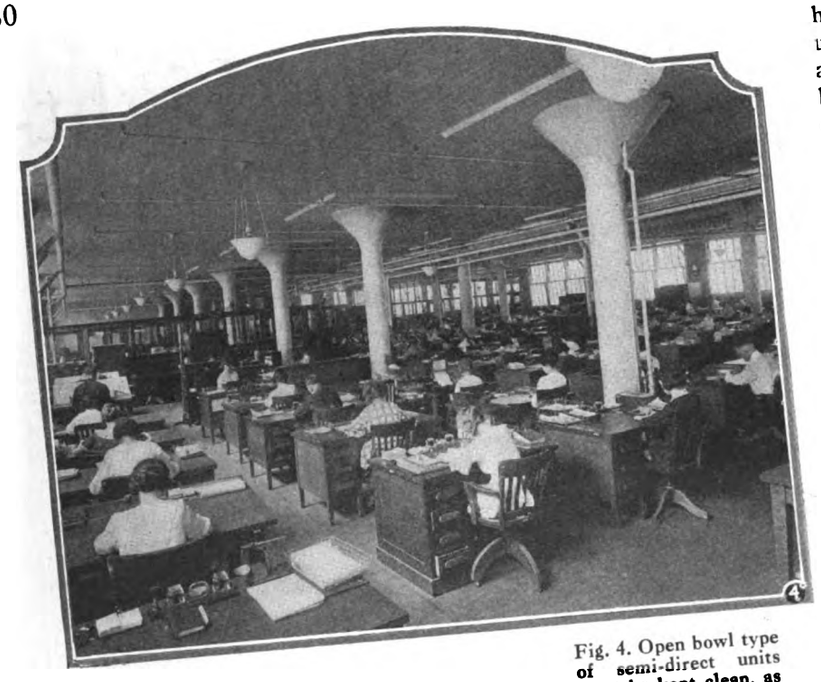


Fig. 4. Open bowl type of semi-direct units must be kept clean, as they collect a large amount of dust.

The relationship of mounting height and spacing distance, to give uniform illumination over the entire area, has been thoroughly worked out by the manufacturers of lighting equipment and this data is available for all types of fixtures. For direct lighting units it is usual to install the unit as high as possible in order to get more cross light, and therefore less dense shadows. Where overhead belting is in place the units should be installed at the height of the lowest horizontal belting. In maintenance work it is often desired to use present outlets but to increase the intensity of the illumination. If the ceilings are too low it may not be possible to obtain even distribution when the new larger units are used and in such cases calculations should be made and more outlets installed.

The increase in production due to correct artificial lighting is dependent on whether the operations are manual, semi-automatic or automatic. On operations requiring manual effort and constant use of the eyes it will be evident that the increase in production will be much larger than on semi-automatic or automatic work. On automatic or semi-automatic work the time of the automatic part cannot



Fig. 5. Probably the most intensive research work on proper lighting was first undertaken for retail stores; from many of which we can learn much of value to industry.

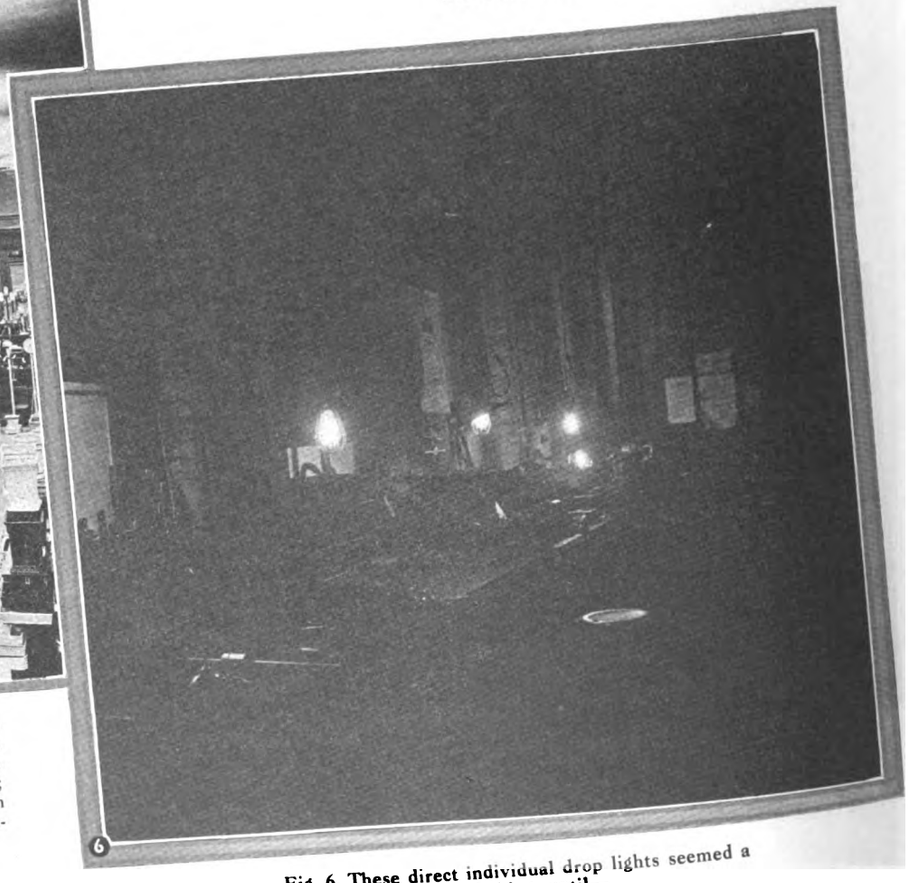


Fig. 6. These direct individual drop lights seemed a logical thing, until—

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be reduced by more light, but the manual part, such as adjusting and setting, will be made faster.

From the safety standpoint general illumination of a reasonable intensity is necessary in all plants. Many accidents are caused by falling or stumbling over obstructions. These obstructions are more easily seen in a well lighted shop, thus tending to avoid accidents. Modern practice provides for a high intensity of general illumination from overhead units with no local lamps, and this practice tends to promote safety and reduce accidents. The records of insurance companies show that the most accidents occur during the winter when there is apt to be poor lighting during the long hours under artificial light. When explosive or inflammable materials are present, all lights should be enclosed for safety's sake. These protective units are made gas and vapor proof for certain requirements, and acid resisting for others where corrosive acid fumes are in the air.

Because correct lighting has a large influence on eye strain, health, amount of spoiled work and general safety of the men, it may safely be said that, other things being equal,

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Fig. 7. Where individual lights are needed, it is well to select those which best meet the need, and they should be installed with every provision for safety.

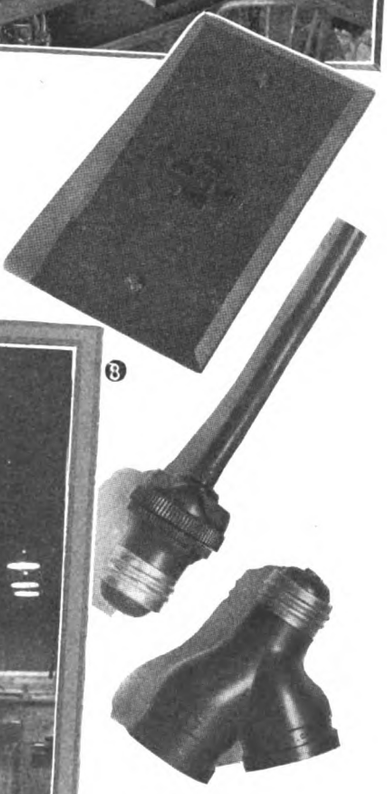


Fig. 8. There is no excuse nowadays for broken porcelain plugs and badly wired outlets.

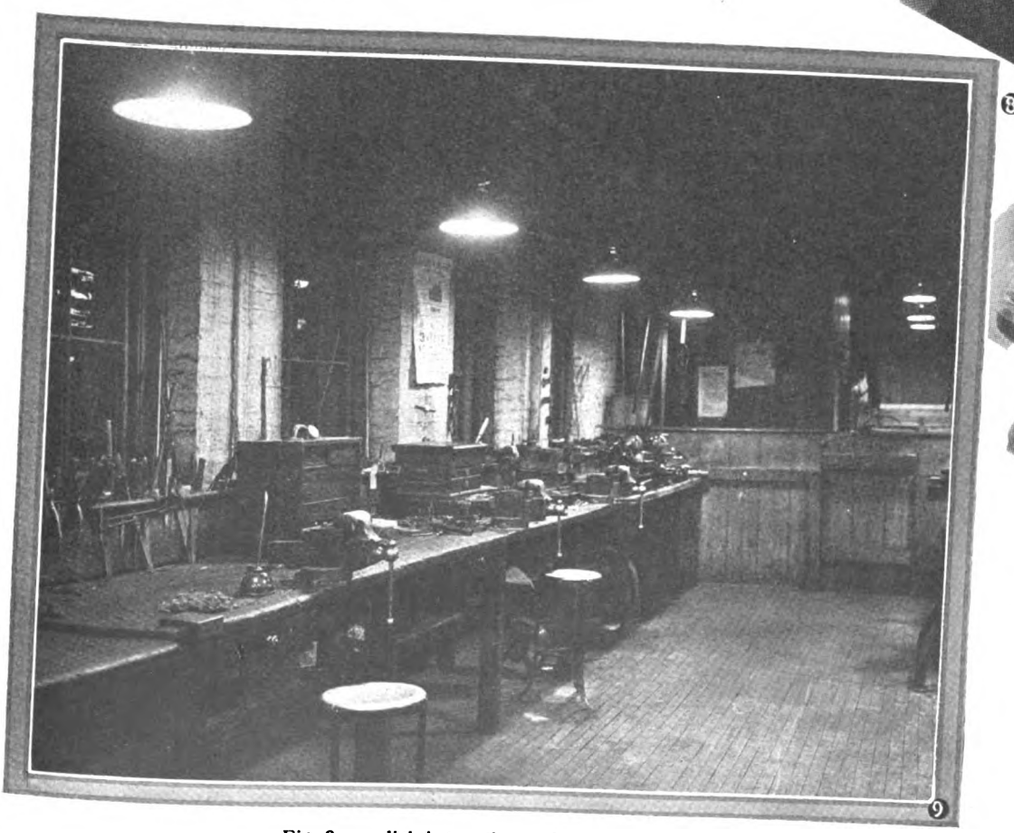


Fig. 9. —a lighting engineer showed what could be done to better them.

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Is There a Materials Handling Industry?

By Matthew W. Potts

ABOUT the year 1895 a new development in mechanical transportation entered the field and the manufacture of many different types of automobiles was the result. Every small machine shop that saw the advantages of this new means of locomotion set about to develop and perfect a model. Within ten years many of the original makers had gone out of business and a number of old established carriage builders were producing cars. In due course it became necessary to bring about standardization in order to meet competition and many individual companies went into combinations. Today the number of manufacturers of automobiles has been greatly reduced and the so-called standard cars are produced in quantity lots in factories built especially for their manufacture. This has all been a direct process of evolution and today we have a well established automotive industry with a well or-

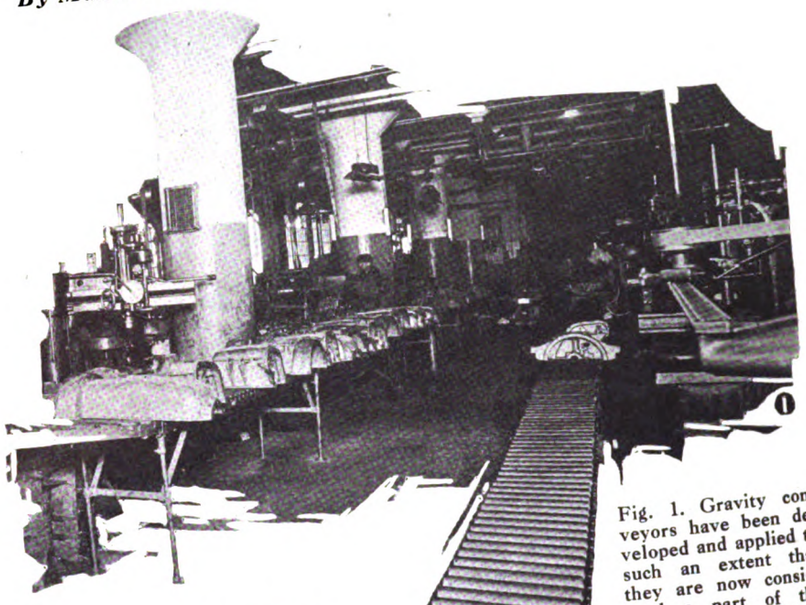


Fig. 1. Gravity conveyors have been developed and applied to such an extent that they are now considered a part of the equipment for machine shops.

Fig. 2. Belt conveyors have been used so many years for handling bulk materials that some believe there is a Belt Conveying Industry.

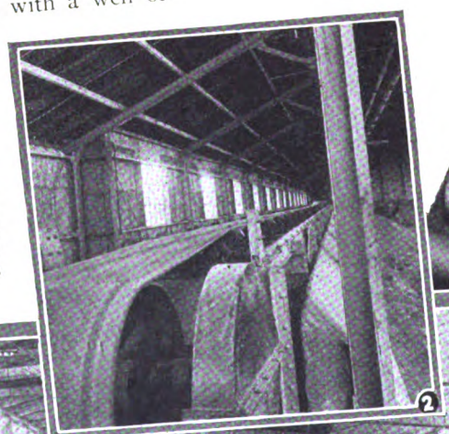


Fig. 3. Coördination of belt conveyors and gravity conveyors in one plant operation shows the value of one main industry with numerous types of equipment.





Fig. 4. The Belting Industry is not a main part of Materials Handling, but considerable equipment is built that uses many thousands of feet of belt per year.

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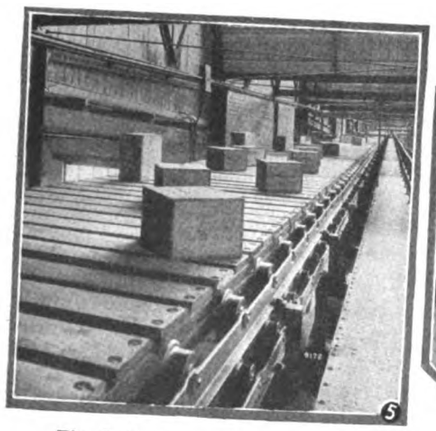


Fig. 5. Some materials as shown would not handle well on belts, so platform conveyors are employed. This type of equipment uses several types and makes of chain, both steel and malleable.

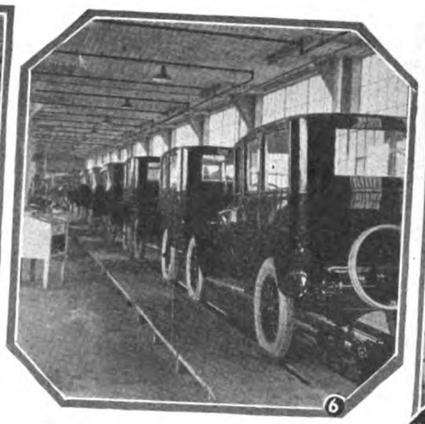


Fig. 6. Here, again, is a different type of conveyor where chain is employed as the moving agent.



Fig. 7. Lift trucks operated by hand are complete within themselves, but is the volume of production great enough to warrant a separate industry?

ganized system of distribution, sales agencies, and service stations.

Is it too much to predict that within the next generation the same thing will happen in the materials handling equipment field? With this thought in mind let us review the past years and consider the new developments and standard equipment that are now being produced.

Let us first look at and consider the development and application of gravity conveyors as shown in Fig. 1. This equipment is now produced by several manufacturers, each using the same principle but differing slightly in construction. These small differences are used as selling points to indicate superior quality, and to justify the higher prices. It is true that for some class of work only the highest type of perfected gravity conveyor should be used but there are a number of handling operations where the cheaper grade has many advantages, particularly if the equipment is to be used

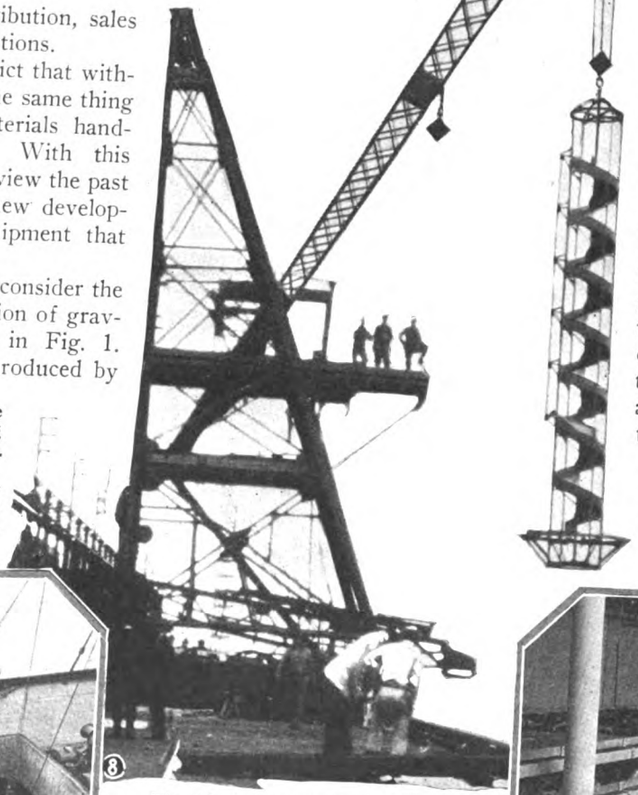


Fig. 8. Close-up view of the installation in Fig. 10, showing the full length of spiral chute.

Fig. 9. Gravity conveyors carry the boxes over the marshes and also from the belt conveyor to the spiral chute.

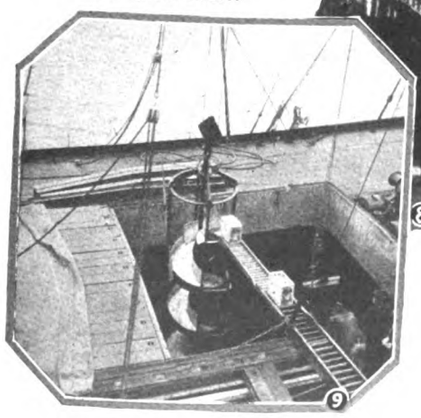


Fig. 10. A general view of a large scale materials handling installation where four or five types of equipment are employed.

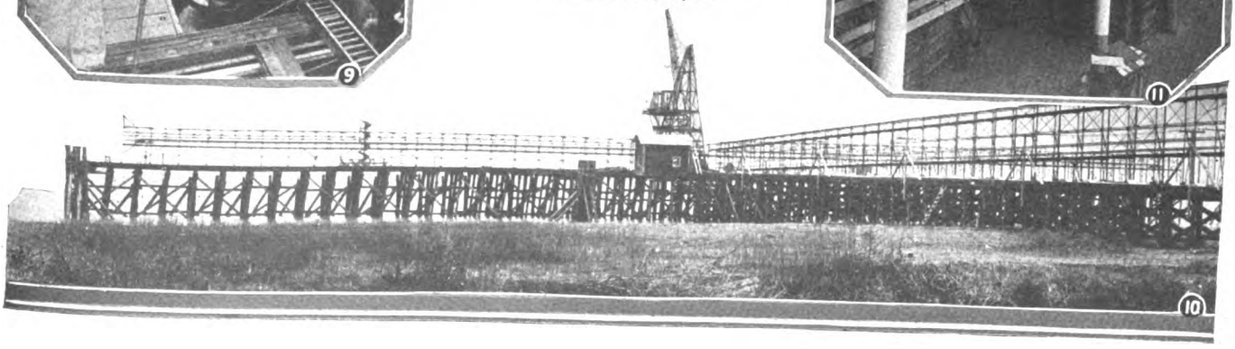
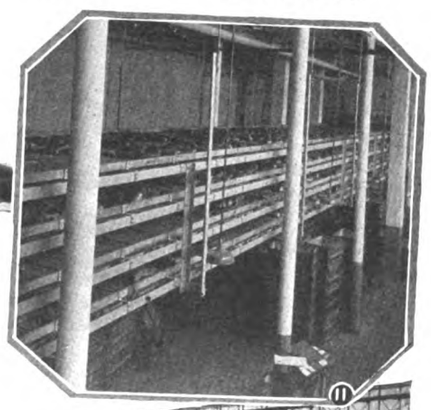


Fig. 11. Industries like to have the equipment fit their particular needs. This cooling conveyor was designed and built for use in bakeries.



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for only a short time and not given the proper treatment.

Gravity conveyors have been developed and applied to such an extent, that they are now considered a necessary part of the equipment for well organized machine shops, shipping rooms, packing rooms; in fact they have their field of operation in practically every industry. This is also true of belt conveyors and as belts have been used for many years for handling bulk materials, some manufacturers believe that there is a Belt Conveyor Industry.

It is at this point that we first see the need of a Materials Handling Industry so as to bring about a proper coördination of various types of equipment. Looking at Fig. 3 we see more than one type of conveyor performing handling operations within a fruit canning factory. At the present time there are several companies who manufacture and sell both the belt conveyors and gravity conveyors and are therefore capable of making a satisfactory conveyor layout as shown, but as will be pointed out later, conveyors are only a small part of the equip-

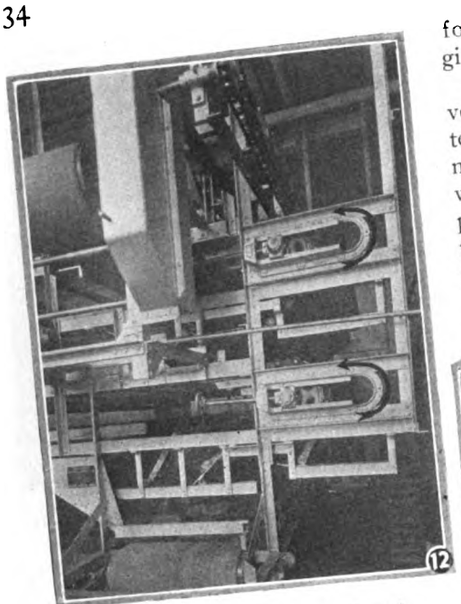


Fig. 12. View showing feed and discharge end of cooling conveyor shown in Fig. 11. Note that belt conveyors bring the bread to and take it away from the special equipment.



Fig. 13. The principle of a tiering machine was employed to make a special machine to fit the job.

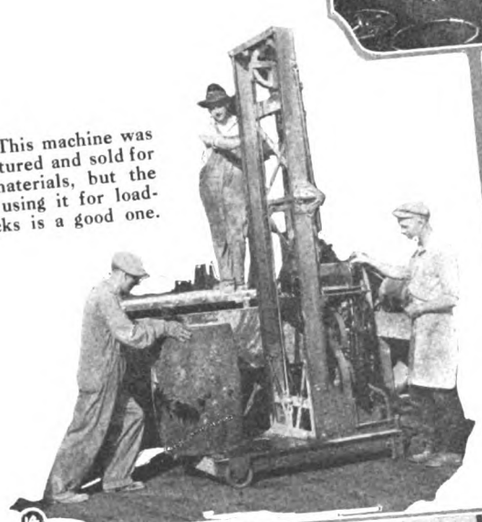


Fig. 14. This machine was manufactured and sold for piling materials, but the idea of using it for loading trucks is a good one.



Fig. 15. The electric storage battery truck manufacturers started with one or two types. Today they make many different types for numerous operations.

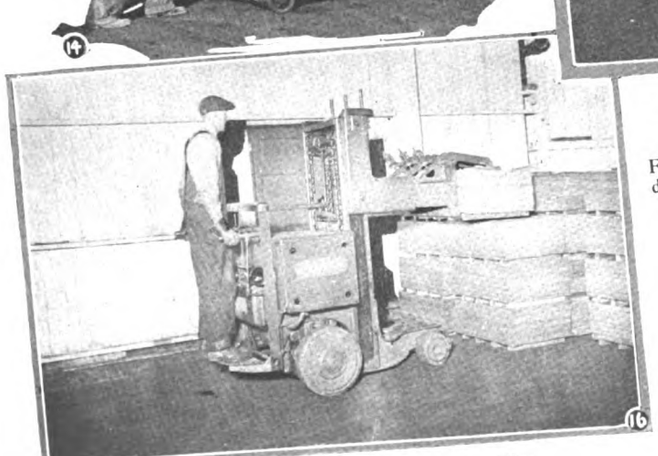


Fig. 16. Many industries are now calling on materials handling equipment manufacturers to solve their problems. This special lift truck platform was designed to handle sheet tin.

Fig. 17. This equipment will handle different diameter reels. Attention is called to the adjustable supporting mechanism.



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ment that is required in most installations properly to handle materials.

There is, however, a great deal of interest being shown by the Belting Industry in the future of materials handling, especially in regard to the use of their product, and one large manufacturer has published a book on the use of their belt on various types of conveyors. Another manufacturer has produced a belt that is used especially for the food products industries, such as bakeries, canneries, confectioners, etc., and in this way has materially built up the former business which was well established.

To show the many uses that can be made of belts attention is directed to Figs. 2, 3 and 4, and these are only a few, as belts are also used on bucket elevators, portable conveyors, package conveyors, and in practically every industry. One of the latest uses seen by the writer was in a meat market, where the belt conveyor carried the meat for a number of butchers to a wrapper, who was located near the cashier's desk.

The belt industry is not the only one affected by the increase in better handling methods, but the chain industry has also benefited and grown as many thousand feet of chain is used in a month to make several of the well known materials handling devices. The places where chains can be employed are at a point where the use of belts is not practical such as that shown in Fig. 5, where heavy cases are being handled. Here some form of platform conveyor is more adaptable

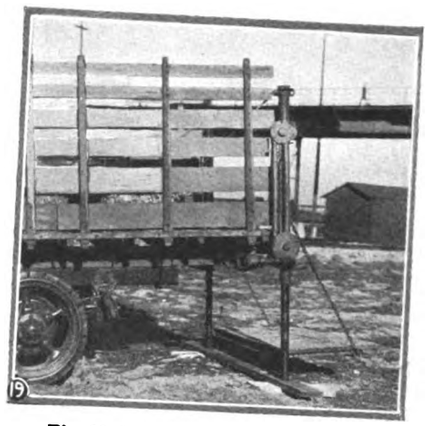


Fig. 19. When the truck is stuck, the elevated end gate (see Fig. 21) is reversed and becomes a jack.

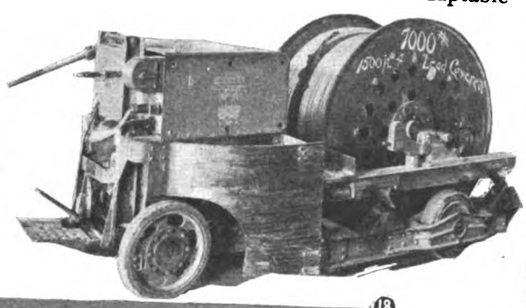
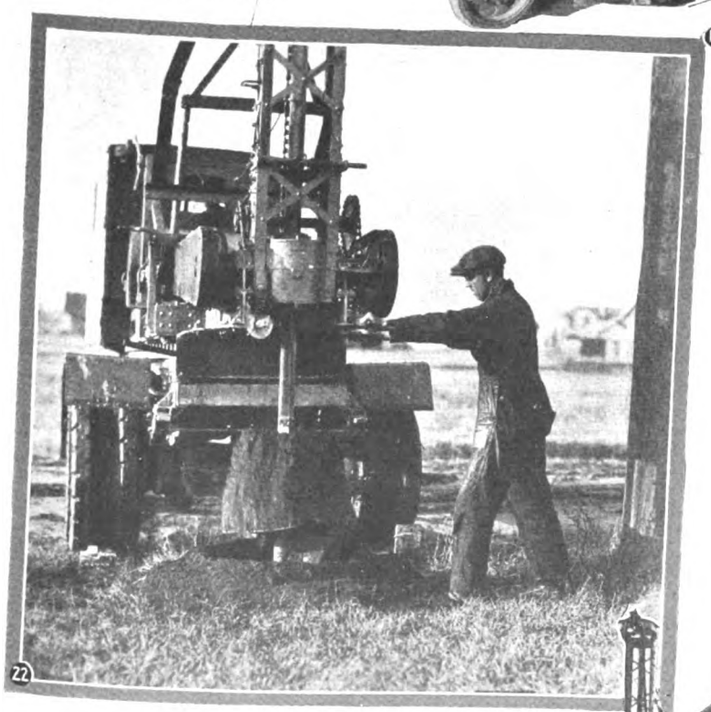


Fig. 18. A new type of electric storage battery truck for handling reels of cable.



Fig. 20. Here the load is raised to the bed of the truck. This type of elevator is always with the truck to assist in the loading or unloading operation.



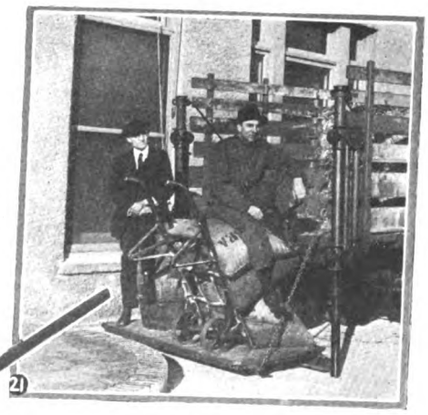
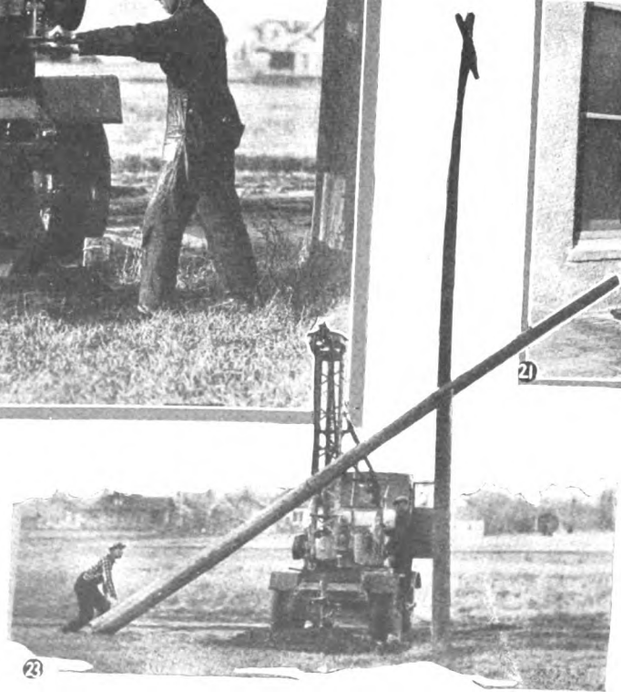


Fig. 21. This elevating end gate is driven direct from the truck engine. This shows it in the down position.



Figs. 22 and 23. Motor trucks are now being equipped with many types of materials handling equipment. This hole digger and post raiser saves time and money and speeds up the work.

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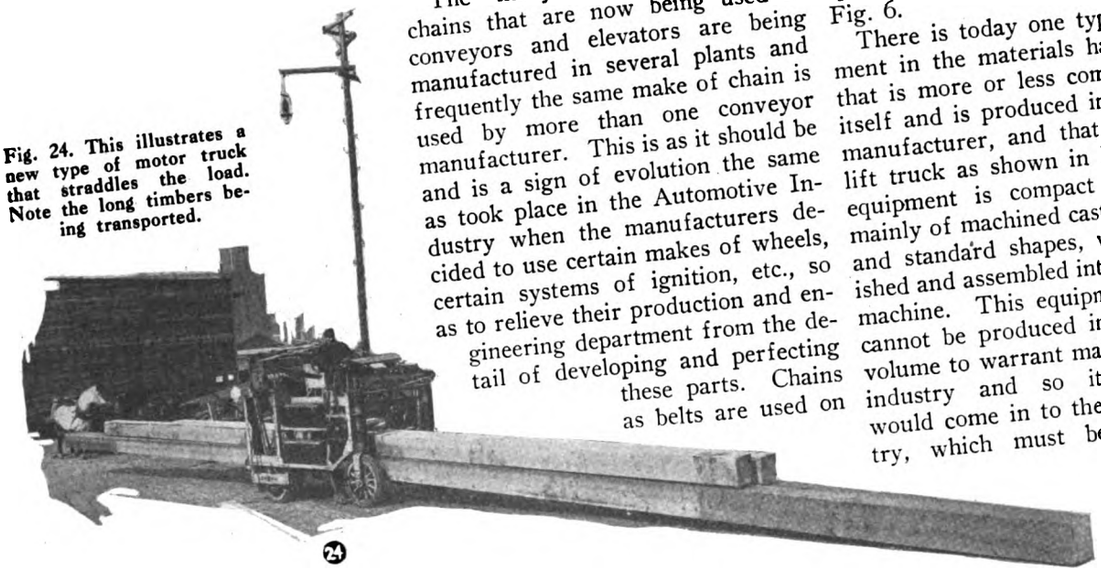


Fig. 24. This illustrates a new type of motor truck that straddles the load. Note the long timbers being transported.

than a belt conveyor would be.

The many different types of chains that are now being used in conveyors and elevators are being manufactured in several plants and frequently the same make of chain is used by more than one conveyor manufacturer. This is as it should be and is a sign of evolution the same as took place in the Automotive Industry when the manufacturers decided to use certain makes of wheels, certain systems of ignition, etc., so as to relieve their production and engineering department from the detail of developing and perfecting these parts. Chains as belts are used on many different types of conveyors and elevators and with a number of special attachments such as shown in Fig. 6.

There is today one type of equipment in the materials handling field that is more or less complete within itself and is produced intact by each manufacturer, and that is the hand lift truck as shown in Fig. 7. This equipment is compact and consists mainly of machined castings, forging, and standard shapes, which are finished and assembled into the complete machine. This equipment, however, cannot be produced in large enough volume to warrant making a separate industry and so it automatically would come in to the general industry, which must be formed, and which will deal with the economic handling service more than the type of equipment to be manufactured.

In order to make this point clear we present Figs. 8, 9 and 10, which show a complete layout and installation where several types of materials handling equipment are coördinated. This equipment was all furnished by one manufacturer and comes under the head-

(*Continued on page* 90)

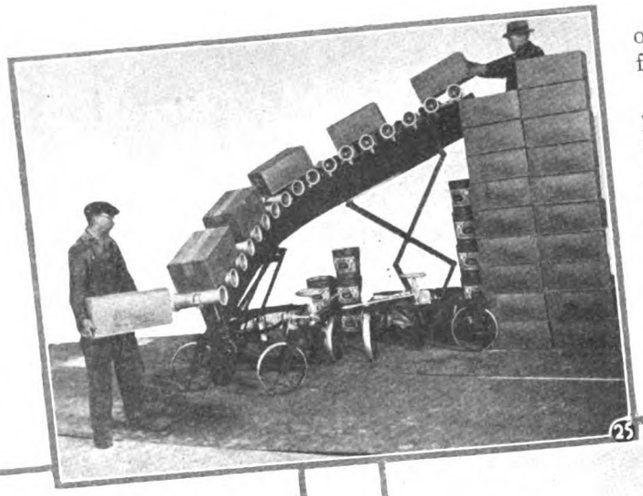


Fig. 25. To carry materials up and around corners at the same time is said to be possible with this new device.

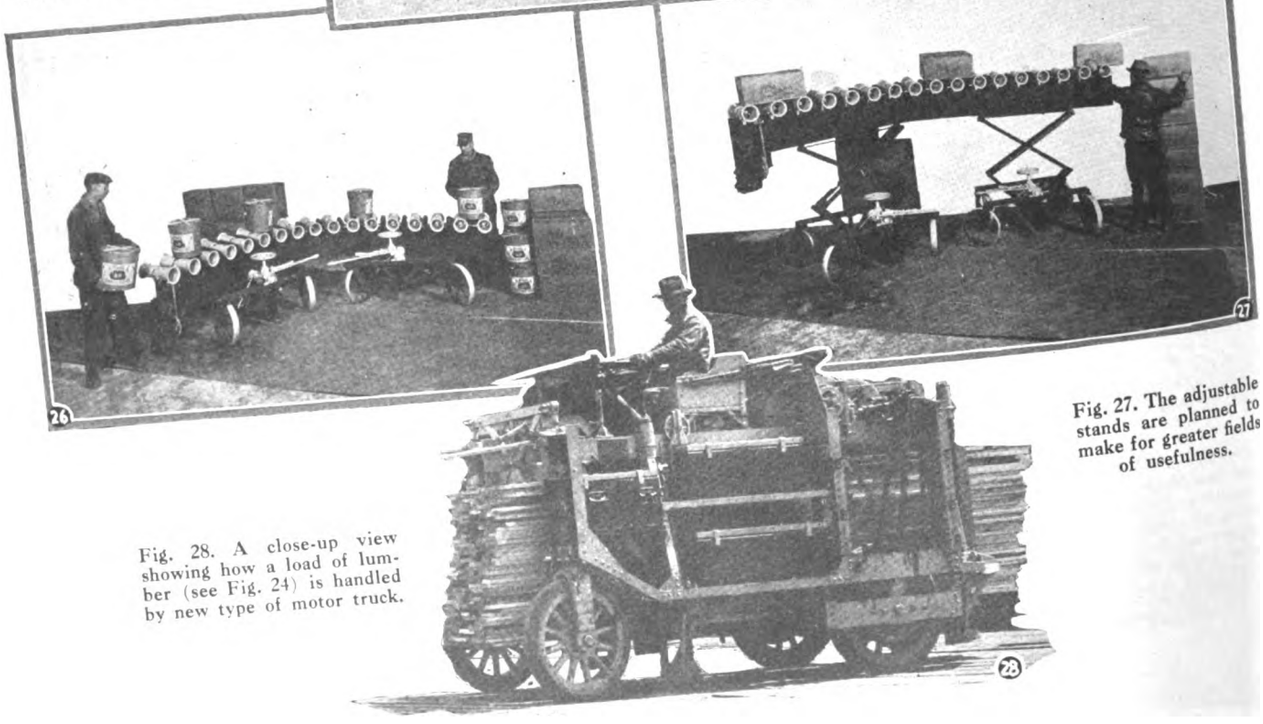


Fig. 26. A continuous power conveyor that would run around corners is new in the materials handling field.

Fig. 27. The adjustable stands are planned to make for greater fields of usefulness.

Fig. 28. A close-up view showing how a load of lumber (see Fig. 24) is handled by new type of motor truck.

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Glare!

Now Eliminated

With 94 per cent Light Intensity Maintained

at Fraction of Cost of Shades

FOR years American Industry has been seeking some satisfactory method of eliminating glare. Shades are too costly. Allowing dirt to accumulate on the glass cuts down the illumination intensity only, while the glare is really aggravated.

But now industries are eliminating glare with Skyco No-Glare. And they are doing it economically—effectively, and with practically no loss in illumination intensity. Actual light measuring tests show that with glare eliminated with Skyco No-Glare illumination intensity is over 94 per cent normal.

Cuts Heat 10° to 15°

Skyco No-Glare is a bluish fluid that you either spray or brush on the glass. It forms a semi transparent film that diffuses the suns rays and absorbs the red rays. These red rays are the heat and glare rays. Thus the natural daylight is modified to an ideal, cool, restful light—the perfect light that has been striven for by much more expensive means. Glare is eliminated. And actual thermometer tests show heat is reduced from 10° to 15°.

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Rain or weather conditions do not affect Skyco No-Glare. Neither will it rub, or flake, off. Yet you can remove it easily with warm water and a brush.

Surprisingly Economical

You'll be surprised at the small cost of enjoying cool, non-glaring, restful illumination with Skyco No-Glare. A single gallon covers from 300 to 400 square feet of glass. The price is only $3.50 per gallon (less in quantities). It is guaranteed by the makers of the famous *Skybryte Liquid and Powder Cleaner.*

Special Trial Offer

To convince you of how economically and effectively you can banish glare and reduce heat we invite you to accept this trial offer:

Order one gallon of Skyco No-Glare at $3.50 F. O. B. Cleveland. Use as much as you wish. Note how easily it is applied. Mark how it defies weather conditions. See how easy it is to remove when occasion requires. Check up how much better work goes on when glare is banished and heat lessened. Then, if you are not delighted, return the balance at our expense and we will cancel invoice.

SKYCO NoGlare

The SKYBRYTE *Company*

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The Brand of Valor

Examples of the stoicism of the Iroquois Indians are almost unbelievable. Self-inflicted tortures established the bravery of these warriors in the eyes of their chiefs, and made them eligible to leadership against the white invaders.

LUDLUM

SILCROME
Valve Steel

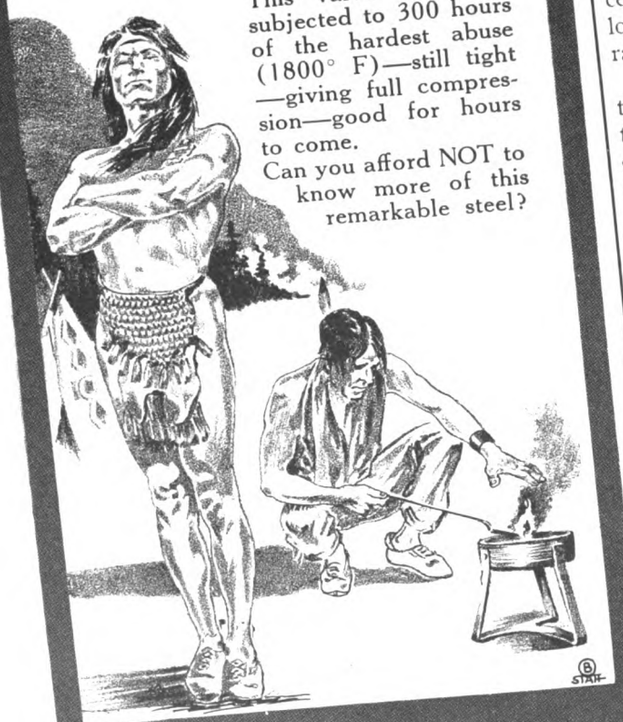
has just such amazing, almost unbelievable qualities; it defies abuse and resists excessive temperatures without burning, scaling or warping.

Note the result of tests made with Ludlum Silcrome, Auto Valve Steel and High Silcromium Steel.



This valve has been subjected to 300 hours of the hardest abuse (1800° F)—still tight—giving full compression—good for hours to come.

Can you afford NOT to know more of this remarkable steel?



LUDLUM SPECIAL STEELS
LUDLUM STEEL COMPANY

STEELS SPECIAL PURPOSES
WATERVLIET-N.Y.-U.S.A.

Meeting Competition by Vertical Combination

(*Continued from page 20*)

veloped vertical trusts in Germany, Italy, France and England. The most complete development exists in Germany, where circumstances combined with the German talent for organization united to create a type of super trust of a stupendous nature.

While in Germany there had been combinations for the manufacture of tin plate and of iron and steel products for a number of years before the war, just as the same thing had grown up to some extent in other European countries and in America, the present organization has assumed economic importance only since the armistice.

During the war every nation discovered the value of pooled resources. Each country had its war industry boards for the control and coördination of industry in the interest of output and efficiency. War driven necessity was the father of consolidation and coöperation among interests which before the war had hated and feared each other and which had practiced destructive competition from their inception.

The state of isolation in which Germany found herself at the close of the war combined with the loss of valuable territories and of important sources of raw materials—especially coal and iron ore and the burden of reparations—all necessitated even closer coöperation among the industries of the country. The promotion of both vertical and horizontal syndicates was further necessitated by the fact that many independent concerns lost, under the treaty, their connections in Alsace Lorraine and Luxemburg.

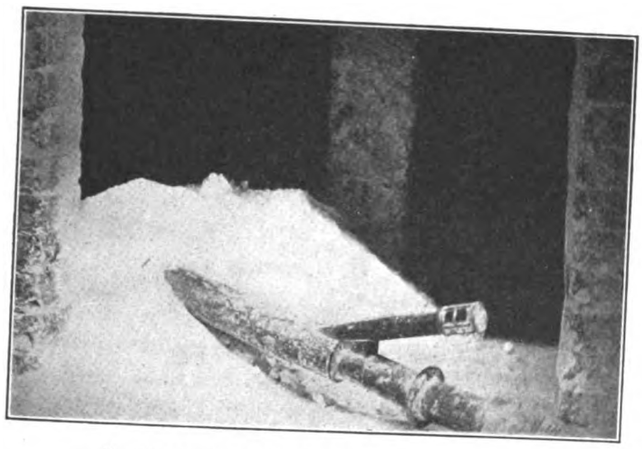
The greatest vertical consolidation, as is natural, has taken place in the mining and steel industries. The thirteen great combines, known as "Konzerns" at present existing are organized as independent and self contained units beginning with the production of iron ore and coal and ending with the manufacture of finished products such as automobiles, locomotives, hardware and various other highly finished products.

These "Konzerns" have combined with manufacture their own land and water transportation systems and have established their own sales offices in Europe and America so that the articles they manufacture are under their own control until they are purchased by the ultimate consumer. The majority of these combines are closely identified with large banking institutions, which permits them to do their financing on the most favorable terms; and a number of them own newspapers, which enables them to mould public opinion in their own favor.

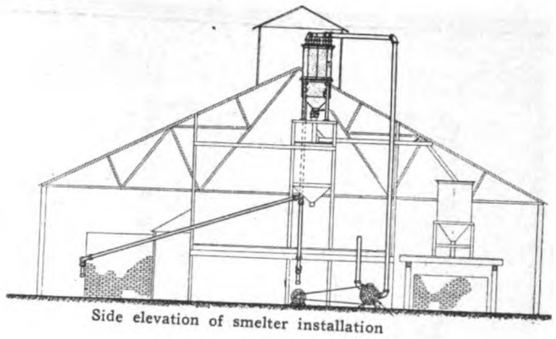
The largest of these is the Stinnes Konzern, a large corporation under a single board of directors known as the Siemens-Rhein-Elbe-Schuckert-Union. In 1923 this comprised 65 iron ore mines, 26 coal mines, 26 blast furnaces, 24 rolling mills, 12 different kinds of steel plants besides automobile plants, transportation companies—rail, river and ocean—and newspapers. It owns electrical plants manufacturing apparatus for signalling, separating metals, purifying the air, drying fish,—turning out cables, wire X-ray machines, microscopes, and building and equipping anything from a subway to a power station.

(*Continued on page 41*)

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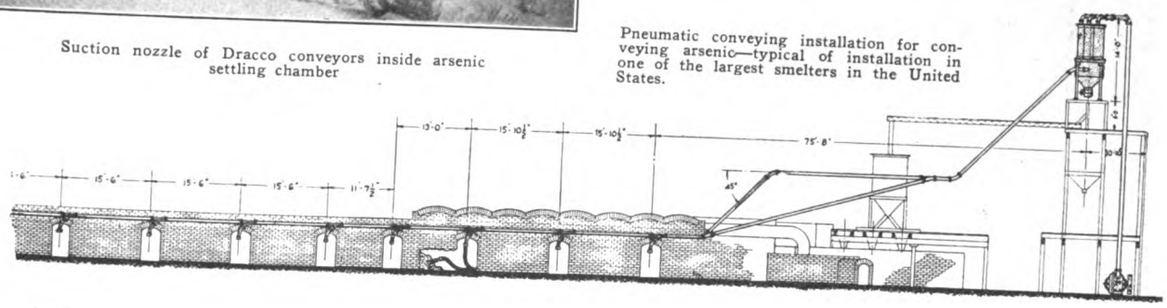


Suction nozzle of Dracco conveyors inside arsenic settling chamber



Side elevation of smelter installation

Pneumatic conveying installation for conveying arsenic—typical of installation in one of the largest smelters in the United States.



For Example—

DRACCO Pneumatic Conveying Installations in Large Smelters

—where the problem of conveying dangerous or poisonous material is an unusually vital one, Dracco pneumatic conveyors overcome difficulties hitherto considered unsurmountable.

The diagram above covers a concrete case—the conveying of arsenic.

Eliminate Costly Handling Operations that are Highly Injurious to Men

The problem was to eliminate the trouble and lower the expense connected with the removal of arsenic from the settling chambers. Previous to Dracco installation, this was done by shovelling the poisonous material into wheelbarrows and pushing these to elevators that finally lifted the material to storage bin. The operation was costly and injurious to men. Both factors have been done away with by Dracco. If you have a similar problem — or an entirely different one—write our engineering department today for their solution.

We specialize on Fume Recovery, Dust Collecting and Pneumatic Conveying. Let us solve your problem. *We can do it.*

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Engineers and Manufacturers, Cleveland, Ohio.

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And by accepting our invitation you will not place your firm under the slightest obligation.

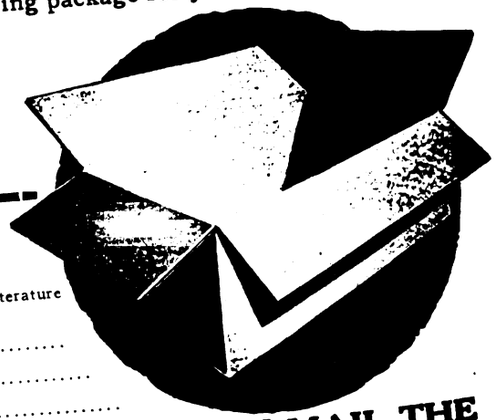
The Service Staff of the World's Largest Manufacturers of Corrugated Fibre Shipping Boxes is at the Free Disposal of All Shippers of Merchandise.

If your present box costs are too high—if your transit losses are running heavy—if you want to improve the appearance of your shipments—put the problem up to the H & D Service Department today. Give us full facts in a letter—or better still, send a sample shipment of your goods and let us make up and submit to you a new container built according to H & D specifications. When you receive the H & D Box compare it with your present packing—safety, appearance, cost, convenience—and note the difference.

A letter (or the coupon) to us—a word of instruction to your shipping department—and you will have taken a step toward a better shipping package for your goods.

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We are shippers of .....

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(*Continued from page* 38)

One man described the operation of this vast consolidation roughly as follows:

"The Stinnes Konzern has prepared a secret official directory containing hundreds of pages covered with names of mines and factories, of their directors and of their products. If any Stinnes factory needs a new dynamo or a supply of belting, the director turns to this directory and orders it from another Stinnes plant.

"If Norway places an order for steel rails, iron extracted from Stinnes Alpin-Montan mines in Austria goes to the blast furnaces of the Stinnes Dortmund plants in the Ruhr where Stinnes coal has been dug and coked in a Stinnes oven, the by-products being despatched to another Stinnes plant. On a Stinnes railroad the coke has been carried to Dortmund furnaces and the waste gases are utilized in another Stinnes factory. The pig iron is taken to a Stinnes rolling mill and made into rails. A Stinnes barge then carries these rails down the Rhine to the warehouse of the Hugo Stinnes Commercial and Transport Company in Rotterdam from which a ship of the Hugo Stinnes Corporation of Hamburg carries the rails to Christiania.

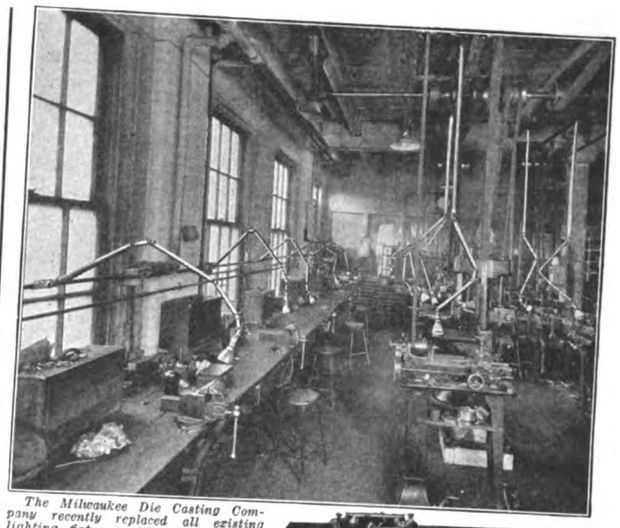
"In this way the Stinnes Konzern keeps the lion's share of the profits—dozens of different profits in the case of a complicated machine—in the family and adds to them by eliminating waste of material, of labor, of sales and administrative expense and of interest on borrowed capital.

"The Stinnes director with the secret official directory in his hands simply telephones his order to another Stinnes firm and enters the debit in his books. His supplies are sent him on a telephonic order, his goods are shipped to Rotterdam on a telephonic order. From the time the iron leaves the mines until the rails are delivered in Norway, not a cent of money needs to pass between the constituent parts of the Konzern. When the goods are paid for in Christiania the Stinnes Commercial and Transport Company pays its bills to the plants which in turn pays the mines. Stinnes capital works day and night.

"Buying and selling are also amalgamated to the greatest possible extent. In the case cited above the Stinnes Commercial and Transport Company which sold the rails would also buy American copper for use in Stinnes locomotives. It can buy more cheaply because it buys in mass and in a way to take every possible advantage of exchange. Since it is continuously both receiving and spending money it can do business with a comparatively small amount of liquid capital."

In securing control of this vast super-trust Stinnes took every advantage of the falling mark and the industrial chaos in central Europe. Some plants he bought, some he secured by the pooling of interest, some he forced to sell out by paying higher wages than his less efficient rivals could meet. Thus three years after the war Stinnes emerged from the industrial chaos of Germany with a supertrust of a range and complexity beyond anything the world has ever before seen.

The A. E. G. (Allgemeine Elektricitäts Gesellschaft) —Rathenau's old company—is nearly as large as Stinnes Konzern. After the war it set itself to acquiring coal and iron in order to insure a supply of raw materials. To these it added other plants. By pooling interests with the Lincke-Hoffman Locomotive and Railroad Car Company which has working agreements with other



The Milwaukee Die Casting Company recently replaced all existing lighting fixtures with an installation of one hundred "American" Adjustable Fixtures with conduit fittings.



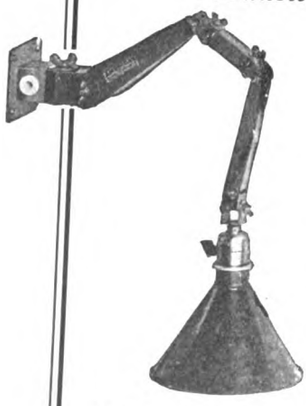
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—to eliminate all glare and eye-strain, and do away entirely with those costly shadows that are responsible for most of the "rejects" and spoilage.

The operator can easily move his "American" Adjustable Fixture into the exact position to cast an adequate light volume right on the work he's doing. The job is not only better done, but it has taken about one-half of the usual time.

Production is increased from 25% to 65%



The many styles of "American" Fixtures are built to fill all industrial lighting conditions; they're made to fit either conduit or open wiring—approved by the Underwriters' Laboratories.

A new illustrated catalog showing styles and prices is ready to mail. Send for a copy now, before it slips your mind.

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Made for maximum service not merely the average

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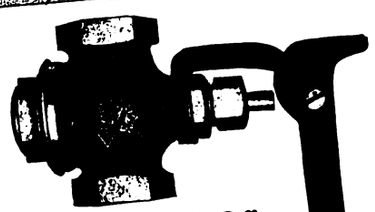


Fig. 720 — Bronze Rapid Action Valve.

For Rapid Action—On and Off

The Jenkins Rapid Action Valve is primarily designed to save time. It also saves water.

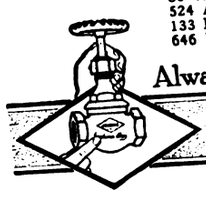
When the operating lever is hanging freely, the valve disc is firmly held to its seat by the heavy phosphor bronze spring and the existing water pressure. A quick upward quarter pull of the lever causes the valve spindle to force the disc off its seat.

A slight pull on the lever, and the valve instantly closes, without water hammer, or any pounding or rumbling in the piping.

Made in sizes ¼ to 2½ inches. Write our nearest office for the "Rapid Action Valve" folder.

JENKINS BROS.

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524 Atlantic Avenue.....Boston, Mass.
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Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

railroad equipment companies it secured control of the largest production organization of this type in Europe. It secured the Deutschewerft—the shipbuilding works of Hamburg—which brought it into advantageous relation with the Hamburg-American Line and with Krupp and Otto Wolff.

Altogether the A. E. G. has no fewer than 872 separate factories and branches. It produces hard and soft coal, iron ore, iron and steel products, electrical equipment of all types, machinery, locomotives and railway equipment, chemicals, glass and porcelain. It promotes and finances transportation and lighting corporations which use its products.

The A. E. G. is one of the most marvelous organizations in the world. It employs hundreds of thousands of men. Every department is organized for efficient operation to the last detail and the men at the head of it possess rare ability. I spent a considerable part of my stay in Germany in 1920 with some of these men—directors, consolidators and engineers—and in studying the plants of the company.[1] We have much to learn from the A. E. G.

The Heneschel, which was a horizontal syndicate of coal mines in 1921, became a vertical trust in 1922 by adding steel plants, chemical plants (Badische Anilin) etc.

The Tietz and Wertheim chains of department stores controlled an enormous share of the retail trade before the war, operating on the principle of cheap buying in large quantities. Since the war two vertical concerns have sprung up in serious opposition—the Karstadt concern which owns seven factories and which is interested in eight more and the Blumenstein concern.

The other konzerns have followed much the same lines. The vertical type of consolidation has been worked out in the pottery industry, the dye industry and along other lines. For the most part these konzerns have been built up along three distinct lines:—

a—Production—in which the subsidiary plants are acquired for the purpose of cheapening production.

b—Merchandizing—in which existing selling organizations desired to insure a supply of products to be sold.

c—Speculative—promoted primarily for the sake of the promoters.

This movement has not been hampered by anti-trust laws because there are no anti trust laws in Germany. However, the tendency has been for the constituent companies in a konzern to maintain a considerable degree of administrative autonomy, declaring their own dividends and managing their own affairs within the limits of their agreements.

These vertical trusts are held together in various ways:

a—Personal Ownership (Stinnes owns only a minor fraction of what he controls. Multiple voting shares are sometimes used.)

b—Fusion or Amalgamation (not common)

c—Ownership of Majority of Stock (not necessary)

d—Holding Company (not common)

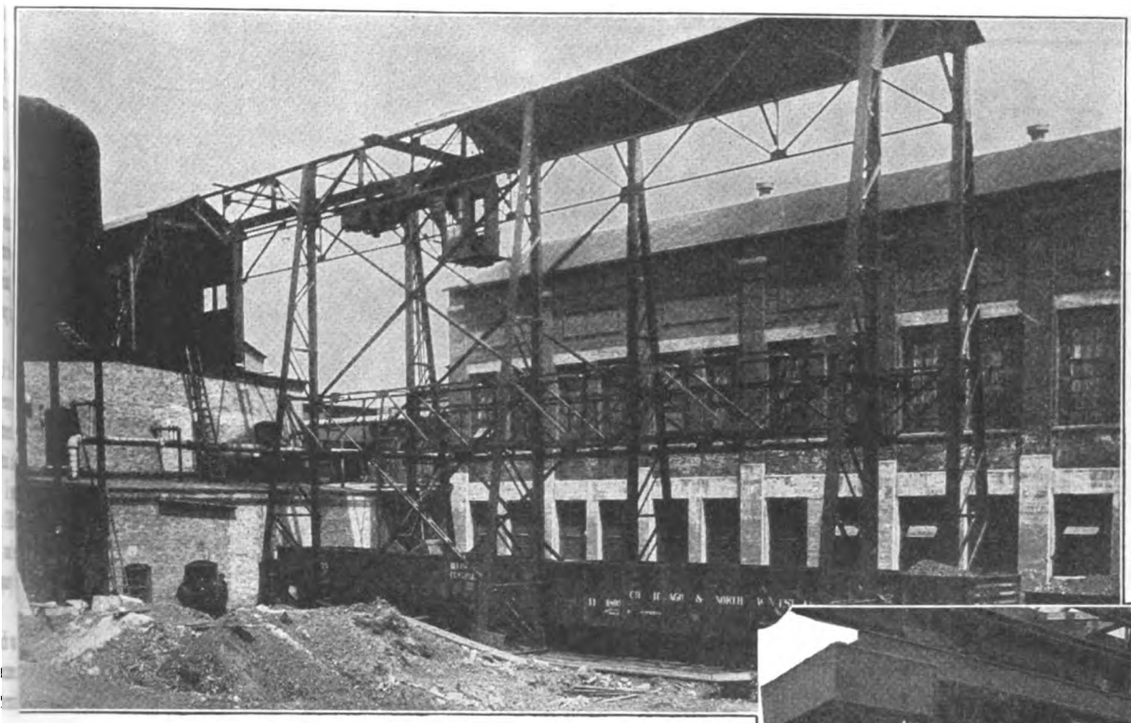
e—Exchange of Shares (common when companies are on an equal footing. Directors are usually exchanged also.)

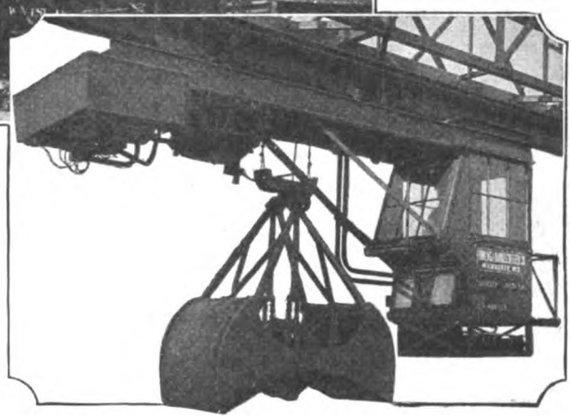
f—Trade Agreements. (One agrees to supply and the other to take at a fixed price. Does not

[1]Note—See "America vs. Europe in Industry" for further details.

(*Continued on page 44*)

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P & H 3-Ton Grab Bucket Hoist, Combined Locks Paper Co. The high lift makes rapid hoisting and lowering essential.

The Higher Hoisting Speeds of the P & H—Increases Daily Handling Capacity

In selecting electric grab bucket hoists don't overlook one of the most important factors,—speed of hoisting the bucket. The amount of material handled depends largely upon this speed.

The greater hoisting speed of the P & H Electric Hoist gives you greater hourly capacity, speeds up production, and increases return on your investment. In many cases this higher speed permits using a smaller capacity bucket and hoist for same output as slower hoist.

Grab Bucket Cranes and Hoists because of storage piling height of hoppers or bins, operate at higher elevations than standard cranes making rapid hoisting and lowering essential.

P & H Grab Bucket Cranes and Hoists can give this higher speed service and yet withstand the severe long hour duty of this type of material handling equipment because of the quality of design, material and construction.



Bulletin 305 gives all the details. If you are interested in keeping operating costs down—send for a copy.

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Dynamic Braking

Used on P & H Grab Bucket Cranes and Hoists eliminates wearing of friction surfaces—and gives the operator easy, efficient control of all hoist motors.

P & H Hoists are rightly proportioned to meet grab bucket service requirements. Larger motors that may be used with P & H Hoist construction insure the higher speed.

All parts are accessible.

Cast steel spur gears with cut teeth are used. Hoisting gears run in oil-tight cases with splash lubrication. There are no planetary gears.

Shafts are turned and ground to micrometer size. Bearings are bronze bushed.

The result is long life, *low maintenance costs,* and continuous every day service.

P&H GRAB BUCKET HOISTS

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Two Dayton Safety Ladders can be used to form a strong, steady scaffold. The unusual width of the working platform allows the use of a very wide plank, and the strength of the ladders will support any desired load. No need for unwieldy trestles.

You are losing money every day your workmen use old-fashioned ladders around your plant.

Most of them are unsafe—and accidents are costly. Most of them require the services of an extra man to hold the ladder and pass up tools.

Work is slowly done because the workman has to use one hand and all his wits to keep from falling off.



This picture shows how the wide leg-spread enables the Dayton Safety Ladder to straddle machinery or other obstructions. A scaffold would usually be required for this job.

With a Dayton Safety Ladder your workman *feels* safe—and *is* safe. He can devote all his attention to his work. The platform is broad and firm and there is plenty of room for tools. He can work with *both* hands. And no helper is required.

Hundreds of industrial plants which have ordered one Dayton Safety Ladder have subsequently ordered anywhere from six to a hundred. They do save money and prevent accidents.

Write today for our illustrated folder, containing full description, sizes and prices. It will pay you in reduced maintenance costs.



Two men can easily work at one time on the platform of a Dayton Safety Ladder — thus bringing four hands to the job with convenience and safety.

The Dayton Safety Ladder Company

Dayton, Ohio

Dayton Safety Ladder

(*Continued from page 42*)

necessarily involve any financial operation. This is the most common way of holding together the Vertical Trust.)

g—The Selling Corporation. This is related to the old Cartell. There are at least six kinds of Cartells including agreements as to:—

1—Sales terms, credits, etc.

2—Prices

3—Sales (Consolidation, etc.)

4—Outputs (Something like the U. S. blind pool of 1905).

5—Purchases

6—Retail Methods.

h—Pooling of Interests—an extension of the trade agreement principle including perhaps—

1—Common Investment in a third undertaking of mutual value.

2—Formal Contract regulating all the affairs of the contracting firms in their relation to each other—supply—price—production—pooling of profits—Under this last each company manages its own affairs, declares its own dividends, etc. within the limits of the agreement.

Finally these monstrous konzerns are all tied together through the Federal Council of Economics (Reichewirtschaftrat)—which is a parliament of business and is on a par in point of authority with the Reichstag,—and with the German Engineering Society which does special research and standardization work. Back of it all is the Organized Economic System (Planwirtschaft) of Bismark and of Rathenau[2] which ties all industrial Germany—capital, management and labor—into one vast machine for the production of goods at prices to undersell all competitors.

In France the Schneider interests form a vertical trust extending from the mining of coal and ore through shipbuilding and automobile manufacture. The Berliet motor plant at Lyon starts with the blast furnaces and ends by placing the finished car in the hands of the consumer.

In Italy the I. L. V. A. has mines, blast furnaces, electric furnaces, factories for the manufacture of refractories, cement, marine and other engineering works, hydro electrical plants and a steamship company.

In England Lever Brothers cover everything in the line of soap from cocoanut groves and steamship lines through the finished product. Vickers is also tending toward vertical trustification, having certain subsidiaries possessed of coal and iron mines in addition to their steel plants and turning out in their Vickers-Metropolitan finished electrical equipment.

In America Henry Ford is working toward the Vertical Trust in two ways. At present his holdings consist of ore lands in Michigan, coal mines in West Virginia and Kentucky, timber in Michigan, West Virginia and Kentucky, water power plants, coke ovens, blast furnaces, foundries, rolling mills, automobile factories, glass, paint and varnish plants, a railroad, etc. He has entered the banking, newspaper and grocery field, is reported as entering the rubber and textile field and has plants and selling organizations not only all over America but in many of the countries of Europe.

In addition to this direct organization of a Vertical

[2]Note—See author's address before the 1922 annual meeting of the Chamber of Commerce of the United States.

(*Continued on page 47*)

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A Shadowless Factory

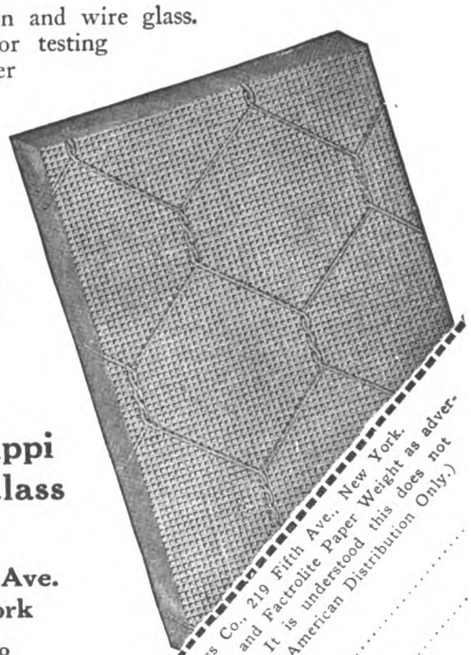
A big Government building 700 x 300 ft. was recently daylighted by over 100,000 sq.ft. of "FACTROLITE." In commenting upon the quality of the daylight *diffusion* in the big structure, engineers remarked—"You cannot see a shadow in any part of the building."

This perfect *diffusion* is a characteristic of "FACTROLITE," which was scientifically determined before we started to manufacture it. Every square inch of "FACTROLITE glass" is covered with 900 minute pyramids, each with a rounded apex and rounded fillets between.

They gather light from a wide angle and deflect it indoors —perfectly diffused. The result is that greater lighting *power* is attained, especially on dull days—and the direct glare of the sun never interferes with work. Freedom from shadows is a third result and an important one, where fine mechanical precision is required.

FACTROLITE

is made in both plain and wire glass. A sample suitable for testing or use as a paper weight will be sent to industrial engineers on request.



This coupon will bring it at once.

Mississippi Wire Glass Co.

219 Fifth Ave. New York

Chicago
St. Louis

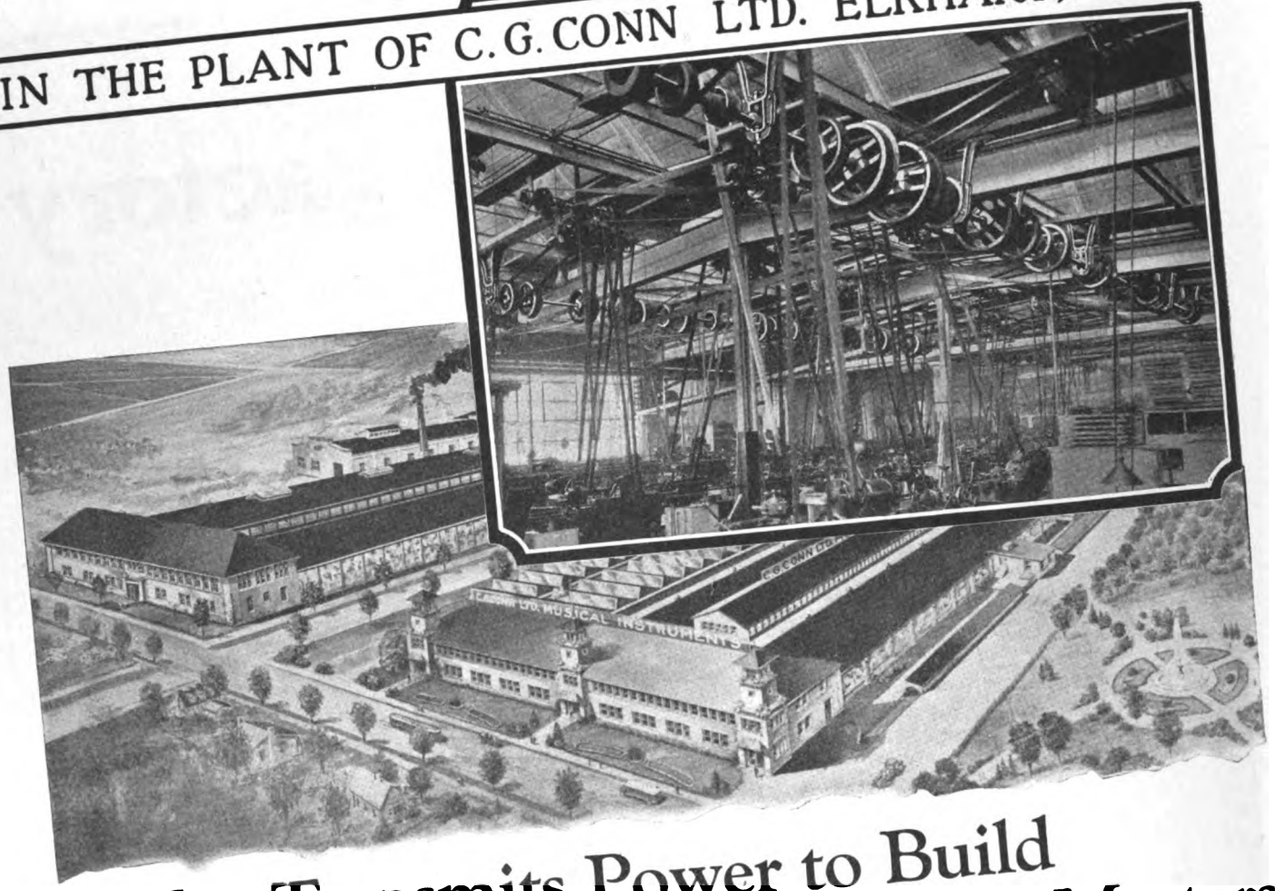
Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way. (For American Distribution Only.)

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Address .....

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IN THE PLANT OF C. G. CONN LTD. ELKHART, IND.



Dodge Transmits Power to Build Instruments for the Masters

From a tiny workshop, employing one crude lathe improvised from a sewing machine, through three devastating fires, C. G. Conn, Ltd., has grown to the large plant shown above manufacturing band and orchestra instruments. 180,000 feet of floor space is overhung with Dodge Power Transmitting Machinery, including pulleys, hangers clutches, etc.

Conn specifies Dodge Power Transmitting Equipment because Dodge represents to Conn what Conn represents to the master musician.

Dodge means power savings. Three large factory warehouses and fourteen branch warehouses supply 500 local dealers who supply Dodge power transmitting appliances on the immediate delivery basis.

Dodge Units Withstand Fire and Water

Some of the Dodge equipment in use today in the Conn factories went through at least one of the devastating fires which reduced three Conn plants to ruins. Salvaged from the ruins, Dodge hangers, pulleys and shafting were again pressed into service, while Dodge engineers worked tirelessly to assist in re-establishing production schedules.

DODGE

DODGE MANUFACTURING CORPORATION *General Offices:* Mishawaka, Indiana *Works:* Mishawaka, Ind., and Oneida, N. Y.

EVERYTHING FOR THE MECHANICAL TRANSMISSION OF Power

Branches: New York, Philadelphia, Pittsburgh, Boston, Cincinnati, Newark, Chicago, Atlanta, Minneapolis, St. Louis, Houston, Seattle, San Francisco

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(*Continued from page 44*)

Trust he has for a number of years obtained many of the advantages of this type of organization by his method of financing himself at the expense of his dealers and of the men from whom he has bought raw and semi-processed materials. He has also secured a considerable part of the competitive strength of the Vertical Trust by his method of becoming a manufacturer's only customer and then fixing his own price. Ford's labor methods are similar to Stinnes' and have tended toward the same effect upon rival manufacturers. It has been his instinctive grasp of the advantages of this type of organization that has enabled him to build up a business that turns out about half the automobiles in the country at a price rivals cannot hope to meet.

Durant has adopted a policy "to keep the profits of the business in the family." To that end he has purchased a large glass plant and is reaching out for other plants. His method of financing, in principle, bears a certain resemblance to Ford's plan.

The consolidation of the Simmons Hardware Co. and the Winchester plant is a step toward vertical consolidation. George F. Johnson with his own tanneries, shoe factories and retail stores has an almost perfect vertical trust. His labor methods are somewhat similar to Ford's. As a result he declared dividends while his rivals were still losing money at the time of the last depression. There is a publishing house in Kentucky which owns forests, pulp mills and type foundries in addition to its regular printing plant. It is putting well printed books on the market through Woolworth. Schwab's activities in acquiring mines and motor plants are steps in vertical integration. A large silk company has formed an almost complete vertical trust and there are other examples in increasing numbers.

While there have been serious doubts cast upon the advantages of consolidation by economists and while there have undoubtedly been disastrous failures, these have, for the most part, been due to the consolidation of industries which were not fit subjects for consolidation from an economic standpoint or to weakness in the human element involved. The presence of a well developed acquisitive instinct does not necessarily imply executive ability on a large scale and a man who has made a million "by his own efforts" has sometimes traded open-mindedness for egoism.

Where conditions and personnel are favorable however, vertical consolidation—

1—Insures a lower cost of manufacture through the continuous quantity production of standardized articles.

2—Saves expense through consolidation of administrative, sales, advertising, insurance, etc., departments. Sells only to ultimate consumer.

3—Saves transportation charges on raw material and finished product, (especially where a certain amount of horizontal consolidation is combined with the vertical).

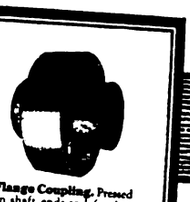
4—Provides for pooling of knowledge, methods and processes.

5—Assures a uniform quality and low cost of raw materials.

6—Makes maintenance of superior quality possible.

7—Reduces interest and depreciation on stores of

(*Continued on page 49*)



Flange Coupling. Pressed on shaft ends and faced to insure accurate alignment.



Drop Hanger. Double brace, four-way adjustment, with either ring, collar, wick or plain oiling bearings.

LARGE STOCKS



Package Car Service

Large stocks of regular sizes of turned and polished steel shafting, couplings, collars, hangers, bearings, split wood pulleys, take-ups and other standard transmission appliances are available for immediate shipment from our plant at St. Louis and our warehouse at Cincinnati.

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Everything in Line Shafting Equipment

Our plant connects directly over its own tracks and switches to 26 railroads offering package car service in every direction.

Your open orders either for stock or made-to-order products will be invoiced according to our discount-sheet applicable to Medart catalog number 43, which you should have on file.

Send your next order, whatever your transmission needs, to

THE MEDART COMPANY

(Formerly Medart Patent Pulley Co.)

General Offices and Works, St. Louis, U. S. A.

Offices in Chicago, Philadelphia, Pittsburgh and New York
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Cast-Iron Pulley. Sizes range from 3-in. to 150-in. diameter, and up to 50-in. face



Gearing. Whatever your needs, we can supply them. Gears cut to 72-in. diameter.

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The Man with the Pencil Didn't Mean to Blunder

MOST of your factory folk are not wilfully dishonest, but they're apt to be negligent and sometimes careless. Give them a time card and pencil, and at the end of a year try to figure your losses from inaccurate records. You will find it a complex business, with losses larger than you had supposed.

The Calculagraph wipes away these blunders—stamps on the time cards the exact time of beginning and ending each job, together with an *automatically printed total of the time elapsed.*

A complete description of the machine and its application in manufacturing plants will be sent you *free on request.* Ask for booklet, "Elapsed Time Records."

The Calculagraph Company

34 Church Street — New York

THE CALCULAGRAPH

THE ELAPSED TIME RECORDER

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(*Continued from page 47*)

raw material and semi-finished and finished products.

8—Reduces amount of capital required per unit produced. No money passes until consumer pays.

9—Increases ease of financing—securities are more liquid and more stable.

10—Permits use of research laboratories—and all that that implies.

11—Increases security of patents and trade marks.

12—Permits securing highest class of administrators and executives.

13—Permits retention of highest class of staff experts—lawyers—engineers—chemists, etc.

14—Makes the most effective type of administrative methods possible.

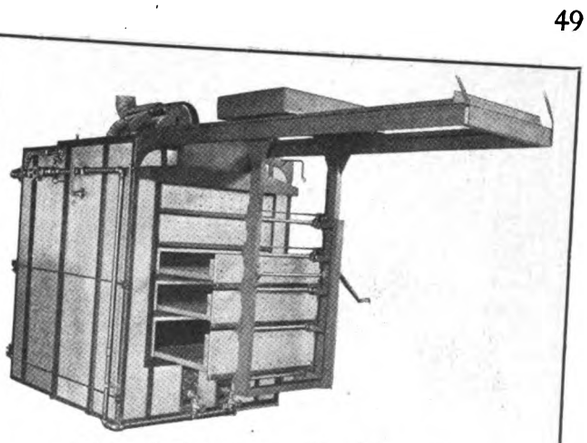
15—Places the industry in a strategic position of great strength.

Where properly organized, the advantages of vertical consolidation are undoubtedly very great. The strength for competition secured by horizontal consolidation was so great that its abuse led to the passage of the Sherman Anti-Trust law. A concern that now controls over forty per cent. of the market for a given product is subject to severe scrutiny by the Federal Government. To date ways and means of preventing cut-throat competition have managed to keep a lap ahead of the attorney general as every big business man knows. The distinction between a trade association for the public good and one which operates in restraint of competition is being determined daily in our courts. As long as human nature persists however it will be increasingly difficult to keep the president of the trust controlling forty per cent. of the market and the leader of the independents from playing golf together. As competition from European vertical trusts is felt more and more keenly in our markets it is a question whether the present Federal law will not find increasing difficulty in combating the law of self preservation.

In certain instances it has already been necessary to loosen the bonds. Some years ago the German copper buyers formed a trust and were able to play one American producer against another so as to force down prices below those which American buyers could secure. This helped the German manufacturers to undersell Americans in world markets. As a result legislation was enacted permitting combinations for export trade of a character unlawful in the domestic trade. There is still a weak link in the armor, however, since there are combinations as we have seen in a number of foreign countries which fix the prices of raw materials and finished products which are bought by this country. American buyers have in a few instances combined—as in the case of the department stores. There is, nevertheless, a considerable field which is yet untouched and which has possibilities for the development of buyers' cartells.

The legal phase of the question is an interesting one but is too vast for discussion at this time. The extent to which the Federal Government interferes with vertical consolidation will depend quite probably upon the reasonableness of the men who head them. Personally I believe that the vertical trust is more likely to injure the horizontal trust and its inefficient rivals than it is to injure the public. Certainly Ford and Johnson have made motor cars and shoes much cheaper and have so been of vast benefit to the public.

The consolidation of allied industries has undoubtedly



CORE OVENS

MAEHLER principles of construction, heating, ventilation, and temperature meets every core oven requirement.
Maehler insulation keeps the heat inside the oven properly circulated and automatically controlled. Rejection losses and fuel costs are low.

Give us a description of the oven you need, capacity, size of cores and the space it can occupy in the plant and let us show you how a Maehler Oven will save fuel, increase production, and lower costs of core baking.

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DAYLIGHT FACTORIES



at lowest cost

Save 50%-85% on Labor Costs alone. Spraco Pneumatic Portable Painting Equipment requires fewer men, takes much less time and does far superior work in every way.

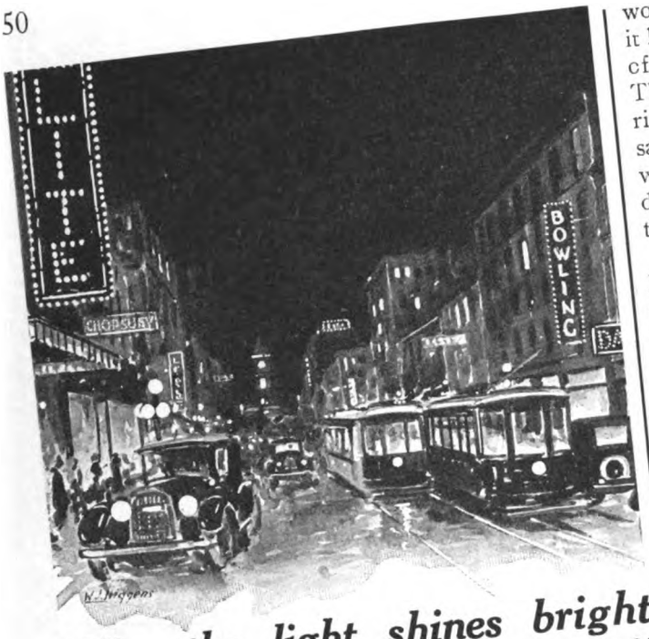
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SPRACO BOSTON

Repaint your Plant the "SPRACO" Way

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Why the light shines bright tonight along "Main Street"

THE light shines bright tonight on your town's Main Street largely because mechanical stokers in the power house are on the job.

The stokers were probably placed there during recent years—were placed there because the use of more electricity had called for more steam to turn generators, more heat to make steam—more heat than could be produced in old fashioned boiler furnaces fired by hand.

And the stokers were placed there by men whose business is selling power—and therefore making it at the lowest possible cost. They were placed there because these men knew that hand fired furnaces wasted their chief raw material—coal. The cost of these stokers had to be justified by operating economies—coal and labor saved!

Can any manufacturer who uses steam afford to overlook the example of men who have made power cost a lifetime study? Is not coal just as definitely a part of every product as the materials used directly in its manufacture?

There is a type of mechanical stoker for plants of every size—a stoker that will pay large returns on the moderate investment it involves. The manufacturer of that stoker has more to sell than an automatic machine for firing furnaces, he has engineering counsel to offer, the product of specialization in the great cost-cutting field of scientific combustion.

Why coal should be your fuel and why a stoker fired furnace is the way to fire it, is told in an interesting book, "Coal —the Basic Fuel." The facts presented in the pages of this book may save you thousands of dollars annually. The book is *free*. Just write to the secretary.

STOKER MANUFACTURERS ASSOCIATION

Ten cars of coal—or nine?

Mechanical stokers save coal by increasing furnace efficiency. They also make it possible to burn cheaper grades and sizes of local coal. Ten per cent saving is a conservative estimate.

Five men or three?

Stoker firing will cross at least two men off the pay roll if adopted by a hand fired plant now requiring five men. The better working conditions appeal to a better, steadier class of men.

Four boilers or three?

Greater steam demands can be met without adding to your present boiler equipment. Three boilers can be made to do the work of four through the higher combustion rate made possible by—

STOKER FIRING

This Book FREE

BURN COAL

"The Basic Fuel"

STOKER MANUFACTURERS ASS'N

G. A. Sacchi, Secretary, Lester Branch, Philadelphia

worked in both ways. With this type of consolidation it has been possible to cut prices below cost in one branch of the business while making money in several others. This has permitted an aggressive concern to force one rival after another to the wall while still maintaining satisfactory earnings for the company as a whole. Just what happens when the concern is master of the field depends again upon the reasonableness and vision of those in control.

Vertical consolidation requires much more careful preliminary analysis of the situation and of the properties to be consolidated than does horizontal consolidation. In the latter case an appraisal of fixed assets, certified and consolidated balance sheets presenting proof of satisfactory financial condition and of earning power in the past of a sufficient number of concerns of a nature subject to effective consolidation are all that have usually been considered necessary aside from the requisite business diplomacy and financial backing.

Of course, if a business is of a speculative nature which permits of little increase in operating efficiency through horizontal consolidation or if a consolidation is subject to attack by a consolidation of allied industries or by a vertical trust, or if it in some other way violates the fundamental axioms which experience in horizontal consolidation have established, such a consolidation will not realize the profits which its promoters predicted.

On the other hand it is possible to form a horizontal industrial consolidation which later develops a number of weak component parts without serious hazard to the success of the enterprise as a whole. If certain factories prove inefficient they can be closed down and the product turned out more cheaply in the more efficient plants. In some cases plants have been included in a consolidation with the avowed purpose of discontinuing their operation and the consolidation as a whole is in a better condition when this has been done.

The vertical trust, however, is like a building. Each unit is superimposed upon the one below it and the structure as a whole is no stronger than its foundation nor than its weakest story. Great care must be exercised to insure a stable and well balanced structure. It would be folly to place an automobile plant which would take half the output of a steel mill on top of such a mill and operate it at half capacity. It would be equally disadvantageous to place an automobile sales organization capable of selling a hundred thousand cars per year above a plant which could turn out only fifty thousand cars.

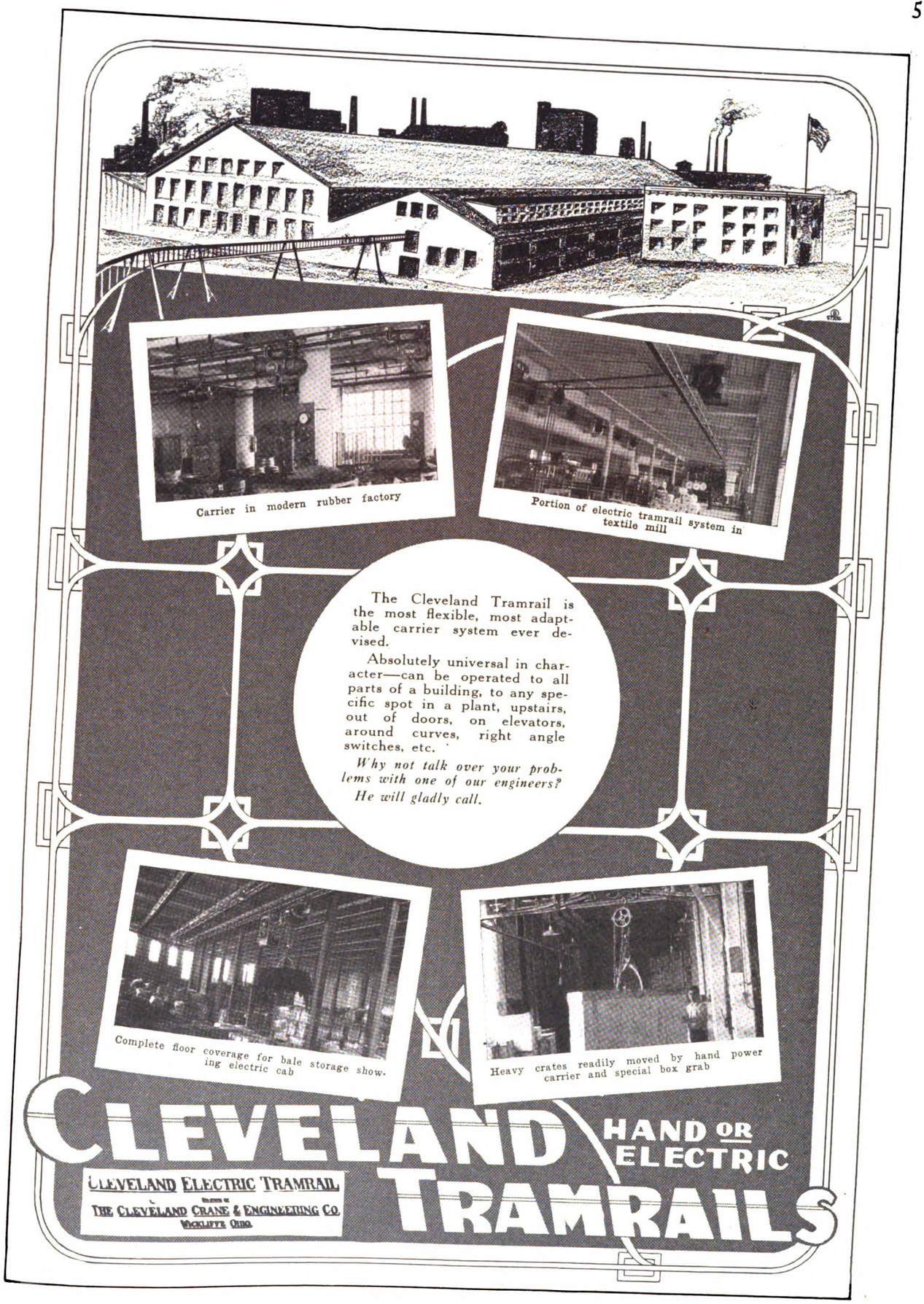
Very often plants in themselves are unbalanced. There are steel mills which could turn out twice their output by building a few more open hearths without increasing their investment in previous or subsequent departments. There are a great many plants which could turn out from 25 to 50 per cent. more product if they were efficiently managed.

To secure, therefore, a well balanced, self-sufficient vertical trust it is necessary to make a very careful survey of the plants to be consolidated and to determine from an engineering standpoint their actual and potential capacities before attempting to erect such a vertical structure as we have described.

Steps must be taken to insure effective management of each plant in the structure. Vickers' attempts to insure this by making each plant manager meet bids from outside concerns in both quality and cost. The disastrous

(*Continued on page* 52)

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(*Continued from page* 50)

effect of having several plants in such a structure which could not meet this test can readily be imagined. It is therefore necessary to make sure that each plant added to a vertical consolidation either is, or can be made, as efficient as any of its rivals, if maximum strength is to be secured for the structure as a whole.

A survey of the market and of marketing methods is almost as essential as the plant survey if over capitalization through acquiring plants and sales organizations which later prove superfluous is to be avoided.

In the past, far too many horizontal consolidations have been made for the sake of the promotion profits. More careful analytical surveys of the physical assets by men who understand marketing, production, and business economics as well as finance would have prevented some of our most spectacular failures.

The danger of failure in the case of vertical consolidation is even greater unless a careful and complete survey is made. A vertical structure composed of inefficient and moribund concerns is more dangerous than these structures uncombined unless a careful enough examination of each is made beforehand to make it possible to predict with reasonable certainty the effect of such a combination from the standpoint of production, sales and finance.

There are a great many features of the German methods of vertical consolidation which can be used to advantage in this country with due allowance for differences in law and in racial psychology. It is, however, obviously impossible to enter here upon such a detailed discussion as a consideration of such matters would require.

In addition there is a very definite procedure in affecting consolidation from a diplomatic standpoint. A great many consolidations have died a violent and stormy death after months of negotiation just as they seemed about to be born. The various manufacturers involved in one of our largest consolidations vainly tried to get together for three years. Eventually they put themselves in the hands of a man experienced in effecting consolidations and were combined in less than ninety days.

The vertical trust is already with us. Already our captains of industry of greatest vision—Schwab, Ford, Johnson, and a few others not so well known, have realized its possibilities. We are in competition with the vertical trusts of Europe in world markets. We may deplore its arrival but in the face of present competition it is too profitable and too necessary to long remain an innovation in America.

OUTSTANDING manufacturing problems will be considered at the forthcoming annual meeting of the Chamber of Commerce of the United States at Cleveland, May 6 to 8. A special group meeting of leading manufacturers from all over the country will be held on the opening day of the convention, under the auspices of the Chamber's Department of Manufacture, of which E. W. McCullough is manager.

This special group meeting will be devoted almost entirely to problems of particular interest to manufacturers. Discussion of the three major topics of the convention, "Business and Agriculture," "European Readjustment," and "The Responsibility and Integrity of Business" will take place in the general sessions.

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INSTANT MAN FINDER

Finds Wanted Men in 30 Seconds

IN establishments not equipped with a good Call System almost every man-hunt ties up inter-department telephone lines, besides wasting the valuable time of some employee in every department telephoned.

The National Electric Calling System finds the man almost instantly—no one's time is wasted. Code signals sound simultaneously in all parts of buildings or yards. The man wanted hears his code number and gets in touch over the nearest department telephone.

If you have a poor Call System, or none at all, you can stop a costly leak by making a very moderate investment in a reliable National Calling System.

Let us Send You Bulletin C. S. 5

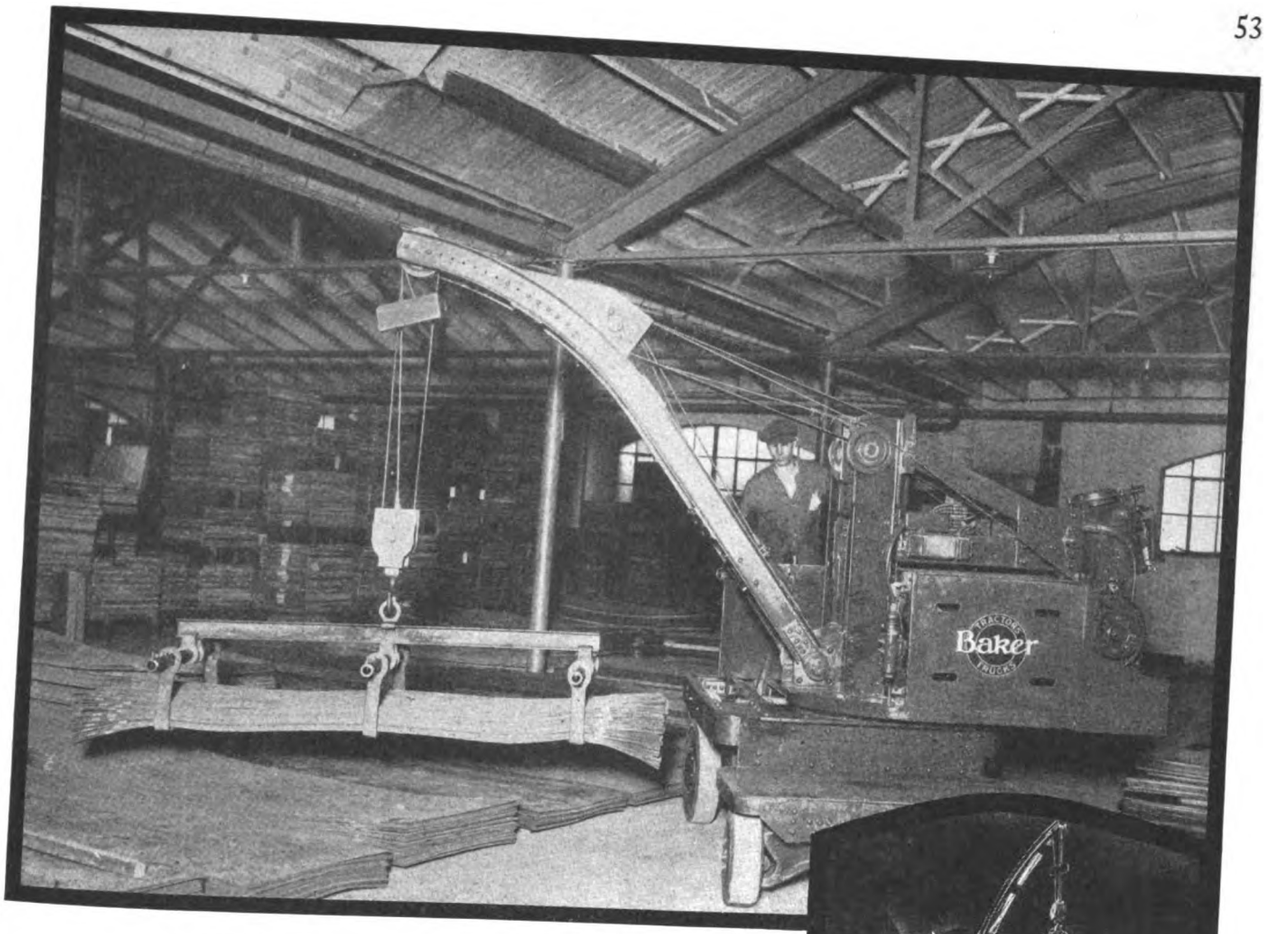
NATIONAL SCALE CORPORATION
5 Bridgeside Ave. Chicopee Falls, Mass.

NATIONAL COUNTING & WEIGHING MACHINES, NATIONAL CALLING SYSTEM, NATIONAL "MULTI-UNIT" STEEL SHELVING, NATIONAL ROCKER-LIFT ELEVATING AND SCALE-ELEVATING TRUCKS.

A touch on the levers—a turn of the dial—and—He's Found!!



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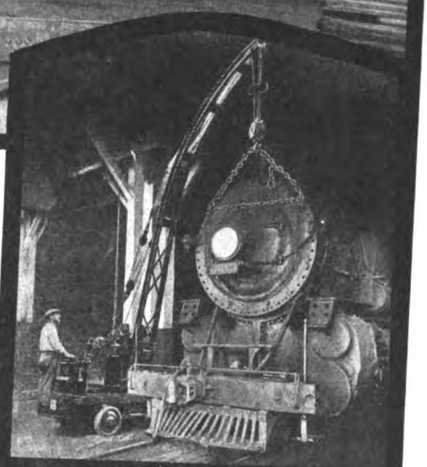
This New Baker Locomotive-Type Crane

Suitable for loading railroad cars, lifting heavy parts, carrying sheet steel, pipe or bar stock can be furnished for operation inside a box car or with boom long enough for erecting jobs and locomotive trimming.

3000-lb. capacity at 7 ft. radius. Travel speed 3 to 4 miles per hour. All motions electrically driven by three separate motors. Standard boom, 12 ft. Booms from 8 to 19 ft. supplied on specification.

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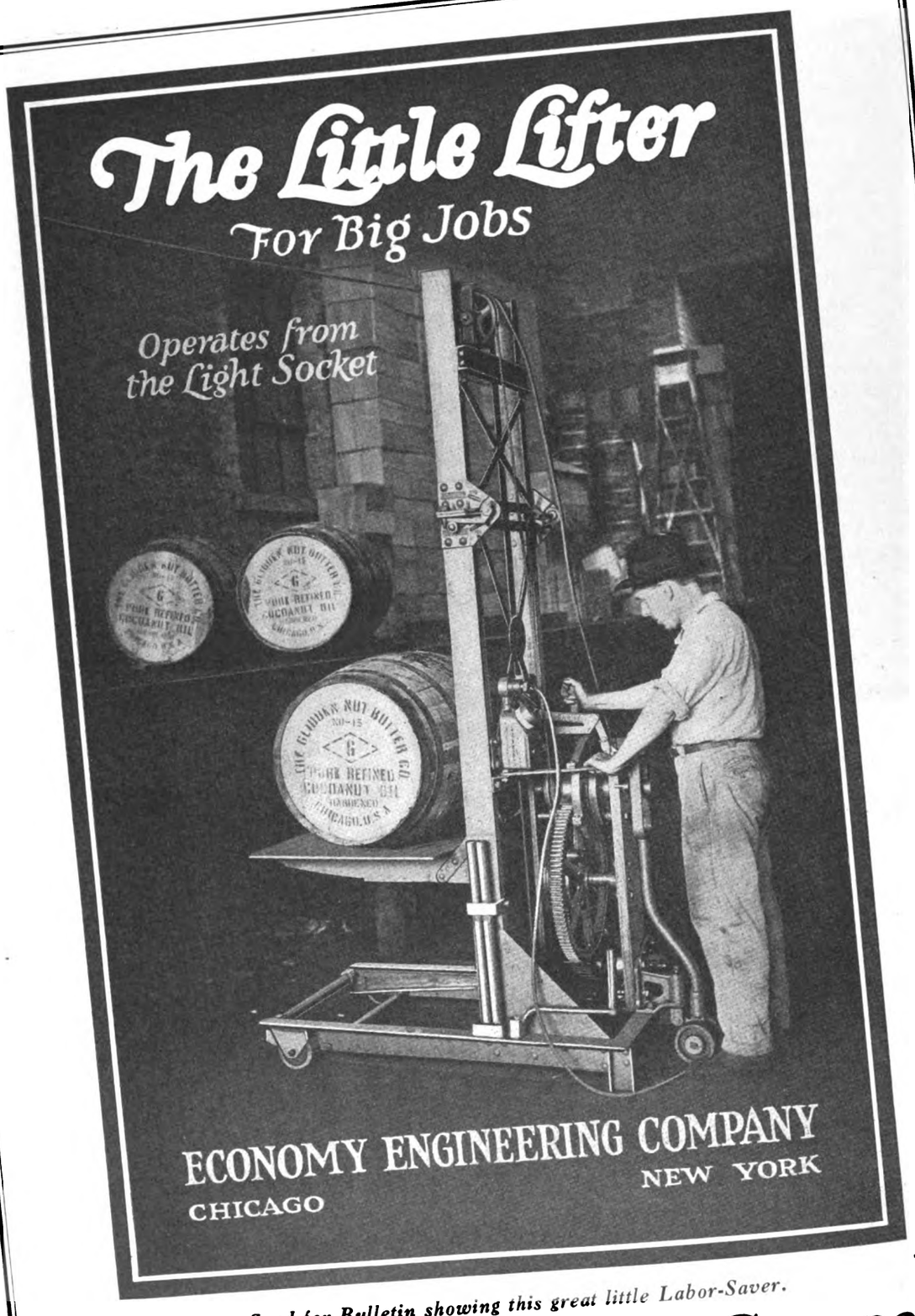
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Keeping the Gear Teeth Quiet

(*Continued from page 23*)

or screw mechanism, or their combinations, which serve to transmit motion. We are chiefly concerned, however, in the average industrial plant with toothed wheels of various designs. Chain drives and friction wheels will therefore not be treated at this time, but will be reserved for individual discussion later, especially on account of the important part which the silent chain drive plays in the expediting of modern plant production today.

Industrial gears will usually be circular, rotating around a common axis with the shaft or cylinder on which they are attached or cut. On the other hand, it is quite possible to extend this principle of the transmission of motion to conical surfaces as well. Individually, they are known as spur, bevel, spiral, annular and worm gearing, according to the manner in which their teeth are cut and the direction in which their motion is to be transmitted. The principle of the gear tooth is also further extended to what is known as the rack and pinion. This includes a flat surface on which gear teeth are cut, these latter meshing with a worm or spur gear (pinion) to bring about reciprocating motion.

Spur gears are those which consist of a cylinder, wheel or disc on the surface of which are cut parallel teeth. Gears of this nature are commonly used to transmit motion from one parallel shaft to another, in either the opposite or the same direction according to the number of gears involved. An intermediate spur gear when located between the two primary gears will serve to bring about the same direction of motion in the driven gear as is developed by the driver. When three gears are involved as above, the size of the intermediate element has no bearing upon the speed attained by the driven gear.

Spur gears are commonly used on industrial machines, working under ordinary conditions, at moderate speeds and with medium pressures exerted upon the teeth. They may be built either encased or exposed, according to the nature of their service and the extent to which they require guarding, or protection against abrasive matter or dust. When exposed, spur gears may often involve lubrication difficulties. Normally they will require a lubricant which will adhere tenaciously to the teeth, capable of withstanding the effects of centrifugal force, speed and temperature changes. Where tooth pressures are not abnormal and the teeth are not subjected to heavy shocks, there is no necessity for the use of a relatively high viscosity lubricant. In fact, too heavy a gear compound will defeat certain of the advantages of lubrication by imposing more or less drag on the gears, thereby increasing their power consumption. As tooth pressures increase, however, the viscosity of the lubricant should be somewhat higher in order to insure that the film on the teeth will be able to resist the cutting and squeezing action especially when sliding motion takes place.

Bevel gears are those whose teeth are cut on an angular surface such as a truncated cone would represent. They are used for the transmission of motion between shafts, the center lines of which intersect, or form an angle between each other. Usually the shafts are commonly located at direct right angles with respect to one another; the gears being known as angle gears. Where two bevel gears are of the same size and their speed

They are human beings

You can't drive your workmen, but man's natural pride in work well done spurs him on unconsciously, if he can see progress.

The Productimeter
The Speedometer of Industry

Breaking records is a game every mother's son enjoys. Put a Productimeter where it shows the record, and the man on that machine will be keyed up to breaking his own record.

Try one at our risk. The effect is noticeable the very first day. But if in 30 days you don't think it worth the cost, return it in good order, and we'll cancel the charge.



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Our catalog will give you some valuable pointers. Write for it.

DURANT Manufacturing Company
608 Buffum Street, Milwaukee, Wisconsin

Maintain Your Floors Without Interrupting Production

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48 Hour Concrete Floor Patcher

QUICKFIX makes a concrete patch of flint-like hardness, ready for traffic *in only 48 hours.* Ordinary concrete patches block traffic and delay production for ten to twenty days while they harden. *With QUICKFIX you can patch the floor Saturday and open it up to traffic Monday.* Any handy man can use it. No costly delays or interference with plant's operation.

Patch those holes *now*—before they get larger. Don't run the risks of injuring workmen, damaging valuable materials, and slowing up production. Use QUICKFIX and eliminate the danger spots quickly. Send for our QUICKFIX BOOKLET with full details. Show your organization what efficient maintenance means.

SANISEAL—Gives any dusting, crumbling concrete floor, old or new, a wear-proof, dust-proof surface. Get our SANISEAL BOOKLET. SANISEAL without SHUTDOWN.

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Gentlemen: Send us complete information about:
Quickfix--for making permanent wear-proof concrete patches in 48 hours. We have _____ Sq. Ft. to repair.
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Maintain Your Floors Without Interrupting Production

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TIOGA STEEL & IRON CO. | WHARTON Jr. & CO. Inc. | PHILADELPHIA ROLL & MACHINE





Cross-section showing Hollow construction

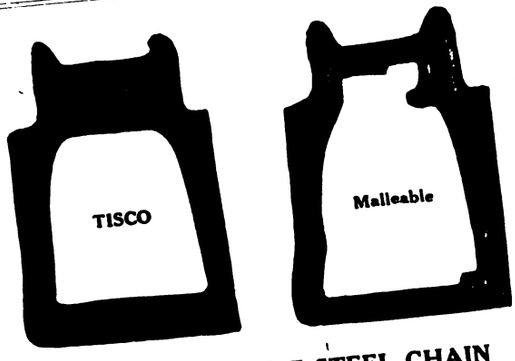
SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Made in one piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained where strain is most severe. Yet, because they are hollow, they are light in weight—saving in freight—easy to handle—power cost reduced. Built on order to meet requirements.

Wm. Wharton, Jr. & Co., Inc.

Easton, Pa.

Cylinders for high pressure gases, Seamless steel tubing, special trackwork for Steam and Electric Railroads.



TISCO MANGANESE STEEL CHAIN

Compare the condition of these two links placed in the same line of chain at the same time—one of Tisco Manganese Steel No. 103 Chain and the other of malleable chain. Manganese Chains usually last from five to fifteen times as long as malleable chains. Wherever equipment is subjected to hard wear or handles gritty materials, Tisco Manganese Steel will give greatest service.

Taylor-Wharton Iron & Steel Co.,

30 Church St., New York City

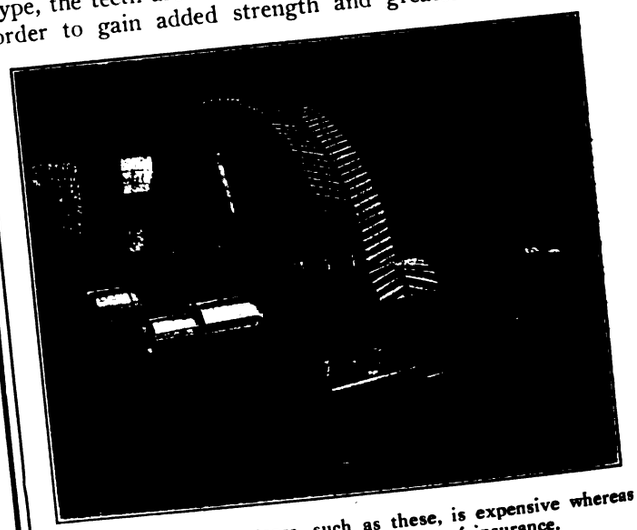
Chain and sprockets — Dipper teeth — Liners for ball mills — Mantles and concaves for crushers —Jaws for jaw crushers.

Bulletins covering the products of the several companies will be sent on request.

ratio remains the same, they are called miter gears. Where of unequal size, they are termed angle reduction gears.

Under ordinary operation, bevel gears will differ but little in their lubrication requirements from spur gears. They will, however, involve the possibility of considerably more sliding motion, with consequently less rolling motion, than spur gears, due to the greater difficulties entailed in cutting perfect teeth and lining up the respective shafts. Therefore it is usually considered advisable to use a somewhat heavier gear lubricant in order to insure a sufficient film on the teeth to resist this sliding action.

Our third broad gear classification includes the spiral, helical gear, or "herringbone" gear. In gears of this type, the teeth are cut on an angle or in helical form in order to gain added strength and greater smoothness



Replacement of large gears, such as these, is expensive whereas proper lubrication is a cheap form of insurance.

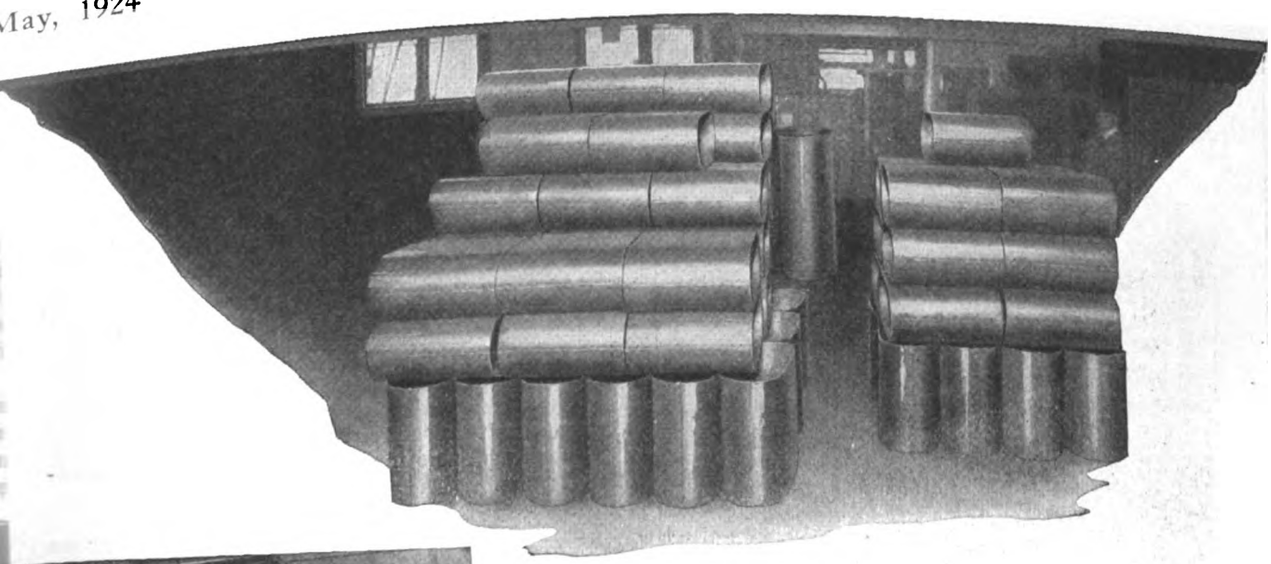
of action than would be possible with spur gears. The teeth of the herringbone gear are cut to slope in opposite directions in order to eliminate end thrust. Therefore, gears of this nature are advantageous for reduction purposes where end thrust along the shafts must be eliminated as much as possible. A further advantage is that wear occurs in such a way as to develop a minimum of sliding friction.

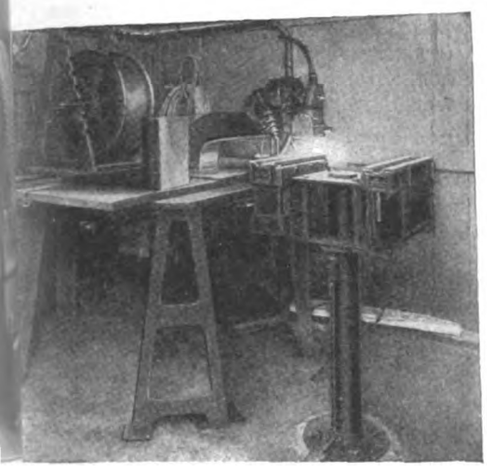
In general, the principal function of the lubricant on a spiral or herringbone gear is to overcome vibration. Vibration or rattling in gears of this type is often claimed to cause pitting along the pitch line, especially where the gears have not been extremely carefully cut or if they are not properly lined up. Pitting is cumulative to the extent that metallic scale may often be developed and broken off with a consequent alteration of the pitch line and rounding off of the corners of the teeth. As a result, such gears are often run in a bath of relatively fluid lubricant to insure maximum protection.

Annular gears or internal gears, have parallel teeth similar to the spur gear, but cut on the inside rim or inner surface of the cylinder or ring. The companion pinion of an annular gear, however, must be a standard spur gear. Annular gearing is often used for large reductions where the direction of motion is to be frequently reversed. The main driving element on certain types of tractors is a typical example of the employment of gears of this type. Lubrication of annular gearing

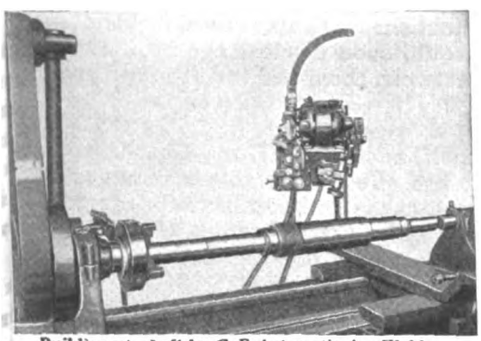
(*Continued on page 60*)

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Straight seam welding of tanks by G-E Automatic Arc Welder.



Building up shaft by G-E Automatic Arc Welder.

Automatic Arc Welding

The above picture shows 50 tanks welded by a G-E Automatic Arc Welder in a half day, as compared to 21 tanks welded by the hand method in a full day. The metal welded is 1/8″ thick by 24″ long.

Through this automatic application of the electric arc, a steadiness of the electrical conditions in the arc is obtained and maintained, resulting in a uniform and high quality of weld—and higher speed. Higher welding speeds produce lower welding costs.

The principal field for the G-E Automatic Arc Welder is the production, by welding, of duplicate objects in considerable quantities.

Its greatest use is for straight line seam, which is the simplest form of weld—but it also does efficient welding of circular seams, and in building up processes on metal.

G-E welding engineers will cooperate with you in making suitable applications of the Automatic Arc Welder to processes of production in your plant. Ask them.

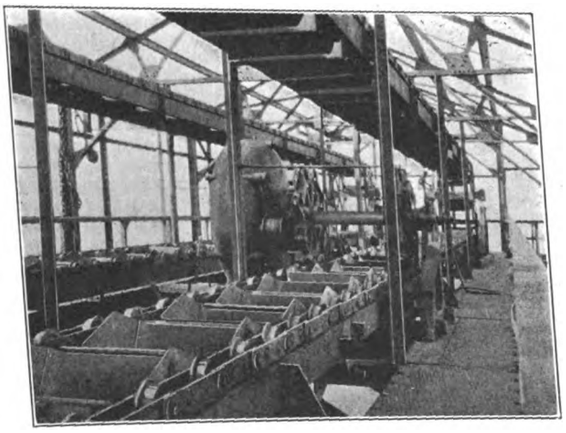
General Electric Company
Schenectady, N. Y.
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8-14

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How Careless Figuring Brings Loss



The illustration above shows a double run of Hunt Pivoted Bucket Conveyors handling coal in a Middle Western City.

Like all Hunt Conveyors this is pawl driven. This method of driving by pawls on studs in chain relieves wheel bearings from the driving strain to which they are subjected with other types of drivers.

An added feature in the above illustration is that all gears are totally enclosed and run in oil, thus prolonging their life and keeping them free from dust and grit.

"* * * * the greatest handicap to efficient business operation is that of incomplete, inadequate and inaccurate information relative to costs and profits," says G. Charter Harrison, in his splendid book, "Cost Accounting to Aid Production."

Computing production costs by intuition, guesswork, incomplete and inaccurate information is too frequently indulged in to provide a working basis upon which to formulate selling costs.

There's the cost of handling coal from car or barge; the cost of rehandling this coal in the plant; and the removal of the resultant ashes. These functions, vitally necessary in the production of power, light and heat, are not always credited in their true proportions.

For example: Inadequate or obsolete apparatus may be causing too frequent shutdowns, resulting in retarded output and expensive repairs;—unsuitable layout may prove too costly;—employment of manual labor where machinery would do the work better, faster and with greater economy;—these are some of the reasons why the initial cost of manufacture is too high.

If the details of the various items entering into the handling costs were shown in their true relation to the production cost, a firmer basis for a reliable and profitable selling cost could be established. Closer study of handling problems would soon disclose the intimate relationship between them and the ultimate profit on sales.

WE DESIGN AND BUILD:

Industrial Railways, Automatic Railways, Cable Railways, Cars, Tracks, Switches, Motor Cars, Scales, Conveyors, Skip Hoists, Electric Vibrating Screens, Cut-Off Valves, or Gates, Weighing and Measuring Devices, Coal Crackers, "Stevedore" Transmission Rope and Hoisting Rope.

For over half a century Hunt Cost-Cutting Equipment has effected notable economies in handling coal, ashes and similar bulk material in every class of industry through its ability to meet all requirements of a perfect system for saving money, time and labor.

Hunt Engineers will gladly lend a helping hand to smooth the way to better profit by planning a suitable coal and ashes handling and rehandling system.

C. W. HUNT COMPANY, Inc.

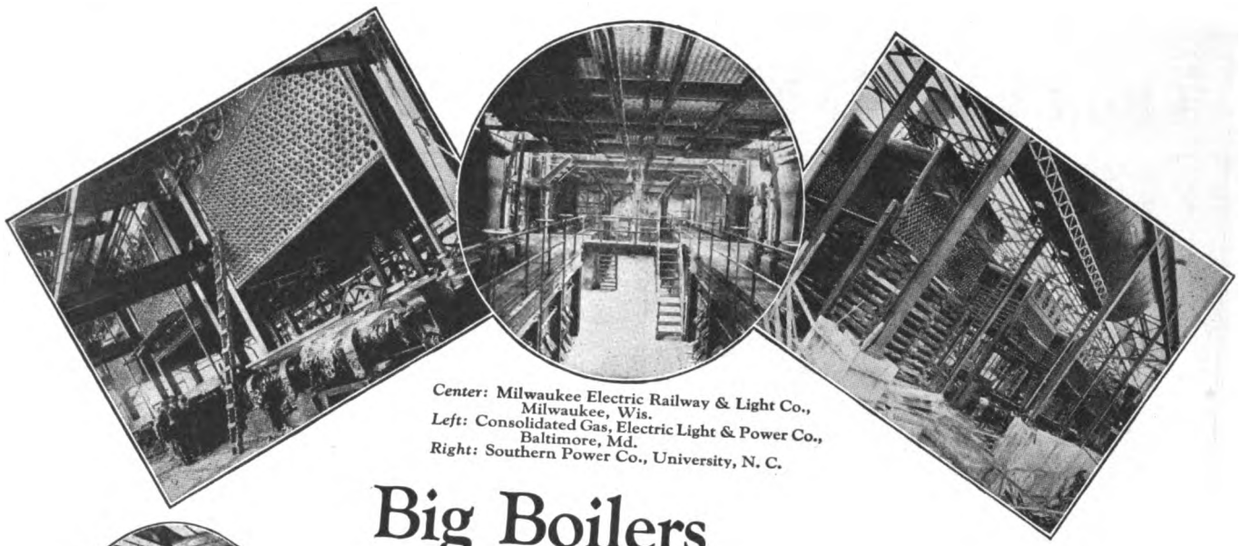
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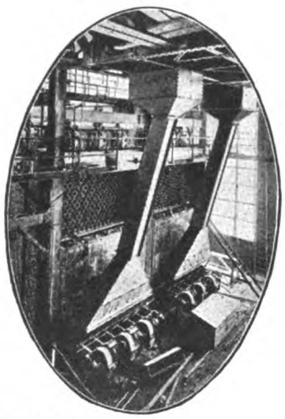
ERNEST F. LEARNED,
141 Milk Street, Boston 9, Mass.

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Center: Milwaukee Electric Railway & Light Co., Milwaukee, Wis.
Left: Consolidated Gas, Electric Light & Power Co., Baltimore, Md.
Right: Southern Power Co., University, N. C.

Big Boilers in Big Plants



Turners Falls Power & Electric Co., Turners Falls, Mass.

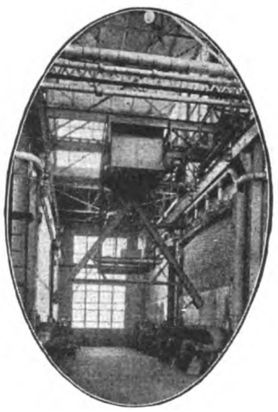
THE seven plants illustrated on this page represent the latest and most modern central station construction. The equipment throughout each of them has been selected because of its superior advantages of economy, efficiency and durability.

There are in service in these seven plants 185 Edge Moor Boilers totalling approximately 160,000 boiler horsepower — an **average of about 866 H. P. per boiler.**

Twenty concerns have a total of more than 400,000 H. P. of Edge Moor Boilers—averaging over 20,000 H. P. for each user.

The fact that every one of these twenty purchasers has sent in several repeat orders is proof of the quality of service rendered by the Edge Moor Boiler in large plants and large units.

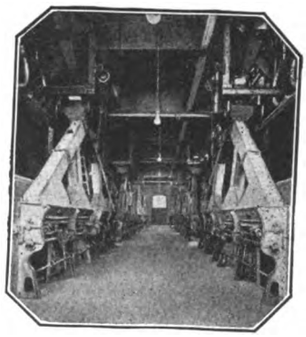
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Iowa Railway & Light Co., Cedar Rapids, Iowa



Metropolitan Edison Co., Reading, Pa.

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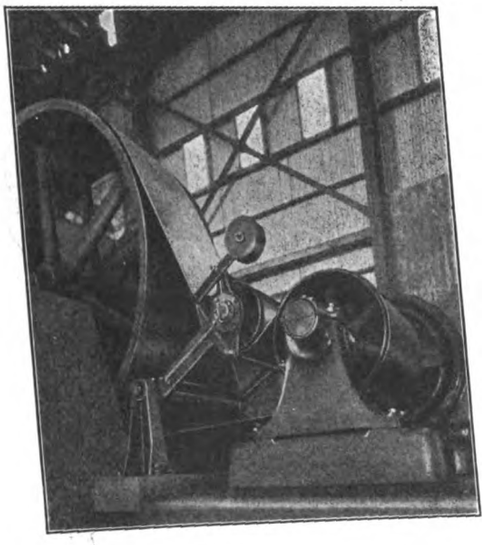
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The LENIX* Drive



"Old Timers"

This Lenix Drive, *installed in December, 1914*, is operating in connection with a 250 H.P. motor driving a crusher at a New England trap rock quarry.

The superintendent says:

"The Lenix has always given good service. We have never found it necessary to do any repairs on same with exception of changing an occasional bearing."

This statement from one who has used a Lenix Belt Drive for more than *nine years* is proof of the soundness of the design and construction of the Lenix.

The Lenix is not an idler. It is a "belt wrapper" scientifically applied to belt drives for the purpose of eliminating slippage and increasing the general efficiency of the drive.

Booklet

"Saving Slippage and Space"

contains interesting data on belt drives. Send for a copy.

*Registered.

F. L. SMIDTH & CO.

Engineers

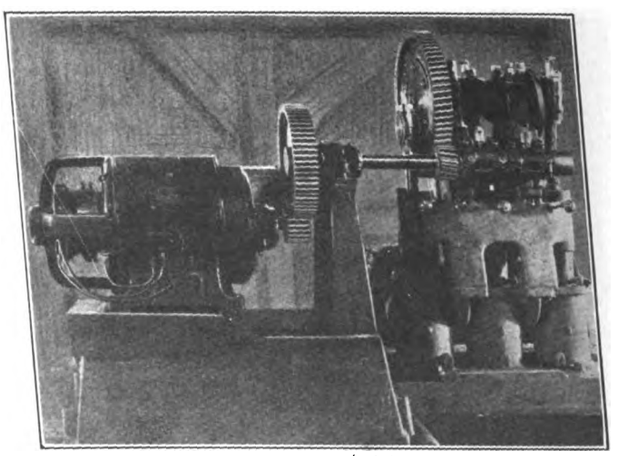
50 Church Street, New York, N. Y.

(*Continued from page* 56)

is similar in principle to that of spur gearing; therefore corresponding grades of gear lubricants can be used.

Worm gears are used where motion is to be transmitted in a right angular direction, or in effect, where two non-intersecting shafts are involved located at right angles, one being above the other. On one of these shafts is fitted a common spur gear, the other carries a collar or drum on which is cut a continuous helical gear tooth all around its surface. Under ordinary operation, the latter, known as the worm gear, serves as the driver, the spur gear being the driven element. Worm gear mechanisms are usually installed where a comparatively large speed reduction is desired with the fewest number of gears.

Worm gears are compact, and, under ordinary conditions, run smoothly where they are properly lubricated. They, however, will frequently present a rather difficult lubricating problem, especially where equipped with roller or ball thrust bearings for the purpose of taking up the end thrust of the worm. In many installations the same lubricant must serve both the gears and thrust



Spur and herringbone gears employed in the drive of a vertical pump.

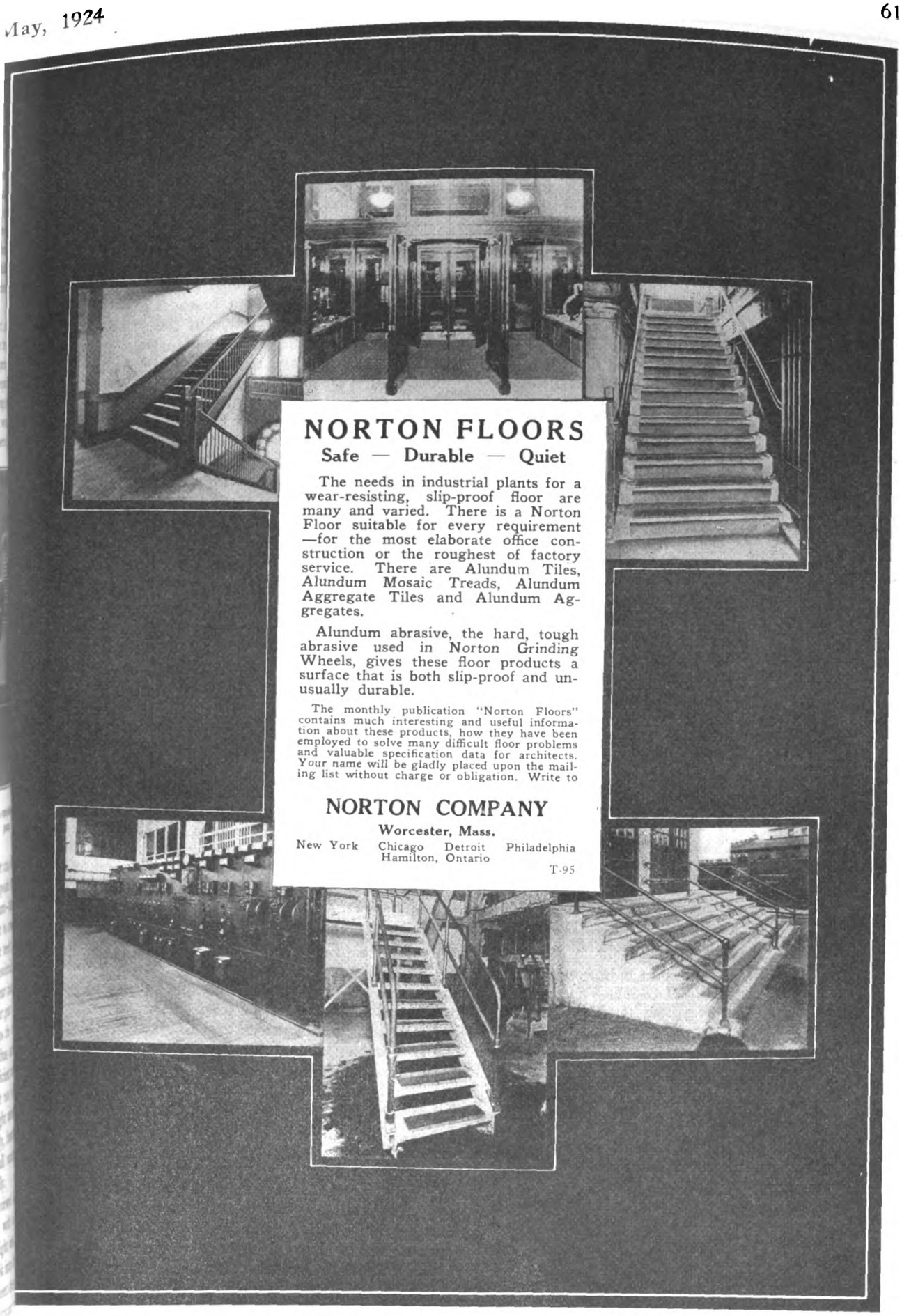
bearings, unless the latter can be lubricated independently. As a result, rather opposite requirements will be imposed upon the lubricant—the gear teeth requiring a relatively heavy product to counteract the squeezing out pressure exerted by the teeth; while the thrust bearing works best where a considerably lighter product is used.

The average worm gear installation is bath lubricated, either the worm or spur gear dipping into the lubricant to the extent of perhaps the depth of the teeth. Upon rotation, lubricant is thus carried to the teeth of the upper element in a sufficient amount to afford a suitable protective film, but yet not in excess to cause "drag." A relatively fluid straight mineral gear lubricant of low pour test will, generally, function best in a worm gear installation and meet all variations in operating conditions most satisfactorily.

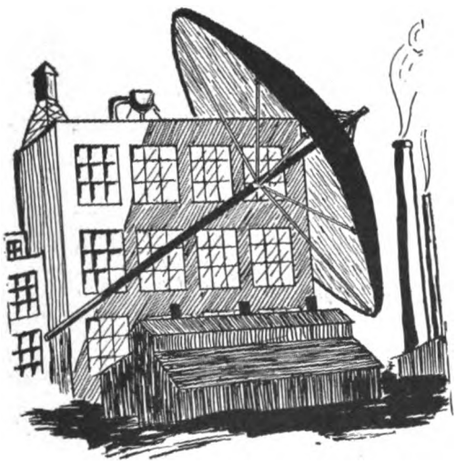
We have briefly reviewed the more usual types of gears that will be met with in the average plant today in order to gain an insight into their lubricating requirements. Now let us look into the selection of the various proper lubricants to meet these requirements. In general, the ideal gear lubricant must possess certain very definite properties such as—

(*Contiued on page* 62)

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As manufacturers know, production increases tremendously on days when there is a haze in the atmosphere, lessening the intense glare of the sun.

BLU-EE, on the window glass, makes this condition constant, prevents eye-strain, allowing no glare, shadows, nor sweltering heat to penetrate into the factory. It acts as a huge sunshade over your plant.

No matter how dazzlingly the sun shines outside, BLU-EE filters out the blinding heat rays and allows only the light rays to enter.



It is more effective than awnings or shades and costs only a fraction as much. Will not rub off, but can be easily removed with warm water.

OUR OFFER.

We will send you a box containing two packages of BLU-EE,—enough to cover 2,000 square feet. Use one of the packages as a trial. If you are not satisfied with the result, return the other at our expense and forget the matter. If it is satisfactory, mail us your check for $5.00 (Discounts for quantity orders). Fair enough, isn't it?

PARK CHEMICAL COMPANY

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Cincinnati, Ohio.



(*Continued from page 60*)

1. Sufficient stickiness to insure that it will remain on the teeth and resist the action of centrifugal force.

2. A fairly heavy body in order to resist the effects of heat, and form a suitable film regardless of tooth pressures or temperatures.

3. No tendency to harden or become brittle and chip off in event of exposure to abnormally low temperatures.

4. Sufficient "oiliness" or lubricating ability to reduce the friction which occurs between the teeth, to a minimum.

5. Sufficiently low cost to enable it to be purchased and applied at a reasonable expenditure in comparison with the value of the service rendered.

All who have to do with industrial plant operation are coming more and more to realize the importance of these requirements in their gear lubricants. By many of them the preservation of their gears is, in fact, regarded as a primary factor in the attainment of maximum production, for they realize the magnitude to which the expense due to replacements, lost time and idle machinery can approach. In fact, using an unsuitable gear lubricant is very nearly as bad as using no lubricant at all, for rusting, premature wear, stripped teeth, excessive noise and detrimental vibration in the entire machine may result, to the undoing of maximum efficiency in the matter of production.

Gear installations involve pressures which are usually high, and especially severe on the bearing surfaces inasmuch as they are borne by a relatively small area of contact. Also, this is a constantly shifting pressure, whereby the metal is subjected to varying directions of load application. Were rolling contact alone involved, the intensity of such a load momentarily on any part of a gear tooth could be disregarded. But sliding motion is practically always present as well, and this explains the abnormal wear that occurs where gears are not properly lubricated, or where the tooth surfaces are subjected to a continual grinding action.

To meet the requirements stated above, numerous gear lubricants have been prepared. In general, they will vary all the way from fluid mineral oils such as steam cylinder stocks, to intricate grease compounds full of all sorts of "fillers" which the makers fondly believe will serve the purpose intended. "Fillers" such as talc, rosin, soapstone, etc., however, serve but one purpose in a lubricant—to give it viscosity and weight. None of them have any appreciable lubricating value. Therefore they should not be used as they are deceiving, and may lead an uninformed user to believe that his lubricant is suitable, when, in reality, it is affording comparatively poor protection against wear. Any such product containing foreign matter will necessarily have low adhesive characteristics. As a result, when used under high speed conditions or wherever the gears may come in contact with water, acids, alkalis, or chemical fumes, the teeth may very soon lose their protective film of lubricant due either to the action of centrifugal force, or washing.

Again where greases are involved, we must remember that from a lubricating point of view, they will only be as good as the mineral oil which has been used in their make-up. The soap constituent serves merely as a sponge

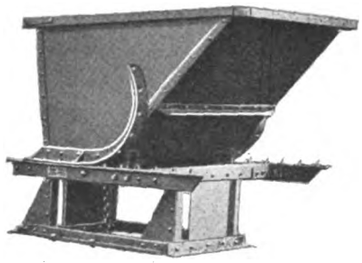
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S-K-I-D-S

and

EASTON INDUSTRIAL CARS


Fig. 6749

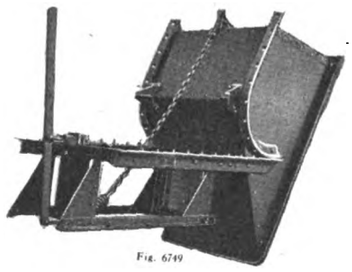
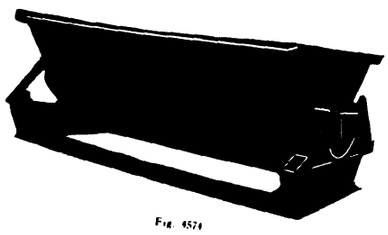

Fig. 6749


Fig. 5904


Fig. 5742

for Every Industrial Purpose


Fig. 4574

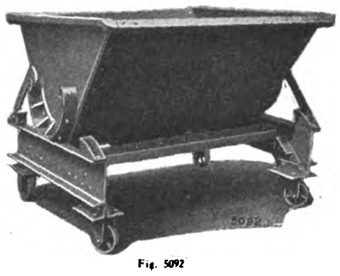
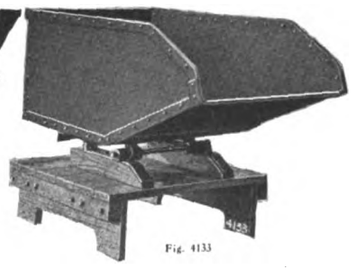

Fig. 5092


Fig. 5916


Fig. 4133

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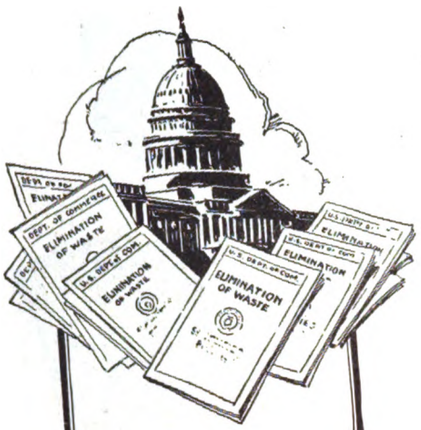
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Jeffrey Engineers gladly will co-operate with you in studying your needs and recommending the simplest, most economical material handling system for your plant. Communicate with the Jeffrey representative nearest to you.

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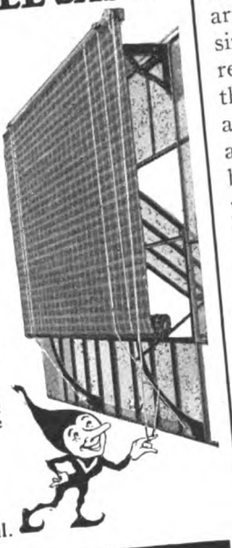
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With average care they will serve 20 years or longer. Built of stained bass-wood strips woven parallel with hard twist seine twine.

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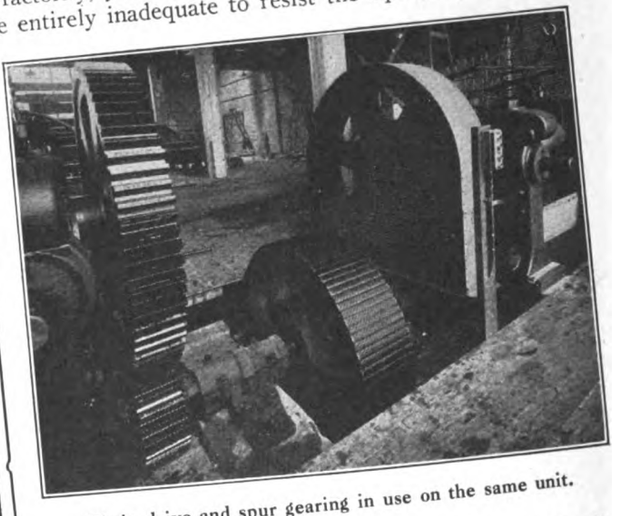
See Sweet's Engineering Catalogue

(*Continued from page* 62)

to carry the oil and retain it in a more or less solid mass according to the percentages of soap and oil which have been used.

Inasmuch as this soap constituent serves no purpose as a lubricant, it is regarded by many authorities as better practice to endeavor to obtain the desired viscosity directly from the mineral oil itself, rather than by using an artificial thickener. This is readily accomplished by simply carrying the process of distillation down until the residuum remaining has been reduced to the necessary thickness or viscosity. Thereby is it possible to obtain a maximum of the desirable properties such as adhesion and lubricating value. On the other hand, if further body is desired, the addition of soaps, animal oil compounds or asphaltum will serve the purpose, and the finished product will be sure to satisfy the essential requirements.

One of the chief faults with any type of light oil grease is that it will often apparently function quite satisfactorily, yet the film created upon the gear teeth will be entirely inadequate to resist the squeezing out action



Chain drive and spur gearing in use on the same unit.

involved. The reason is that the tips of the teeth often exert a so-called "smearing" action on the sides of the adjacent teeth when rolling out of mesh, picking up a certain amount of lubricant which has been forced down between them. As a result the teeth may appear to be carrying sufficient lubricant, yet this only will be present after the pressure between teeth has been relieved. Immediately subsequent teeth engage, due to this lubricant being unable to withstand the pressures, metal-to-metal contact may take place with resultant wear and abrasion.

There are two adverse operating conditions that a gear lubricant may normally be expected to encounter, i.e.,

1. Considerable amount of dust in the air as a result of materials used in the plant, and
2. Excessively heavy pressures such as are customary on certain types of machinery as steel mill rollers or rubber plant mixers or printing machinery.

Where dust must be counteracted, care should be taken to see that the gear lubricant is light enough to absorb considerable of this before it rolls up into balls and throws off. Yet it should still be heavy enough to withstand the bearing pressures on the teeth over the length of time intervening between applications. It must

(*Continued on page* 68)

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Forget what Grandfather's engineers THOUGHT *about Hot Water Heating— Find out what modern engineers* KNOW

"A UNIFORM temperature in the plant regardless of weather conditions."

W. S. McKinstry,
of Winton (Ohio) Engine Works.

"HEATING the additional floor-space (48,600 sq. ft.) is paid for by the saving effected by the use of Hot Water Heat in the main building."

W. T. Cowell,
of Lodge & Shipley.

'ACT statements these, based on actual experiences. They are typical of the re-ts from many of this country's biggest manacturers, all going to prove conclusively that dern Hot Water Heating Systems actually e 20% to 50% of industrial heating costs.

he modern way to all heating systems ndustrial plants is on erformance basis. dern factory owners nt results! Results n as even tempera-s in their plants in weathers, at mini-m cost. Results such re registered in the ompanying chart, ch shows one day's ing performance n the outside thermometer took a charactic drop of 30 degrees.

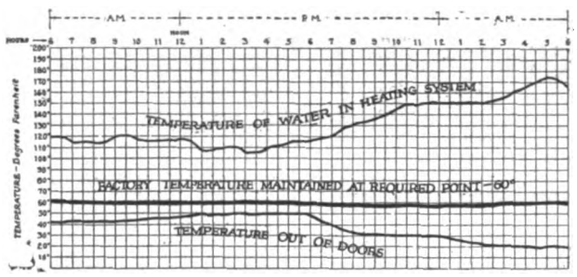


Chart made by recording thermometers in Parish & Bingham Corp. plant at Cleveland, where temperature required is 60 degrees. An even temperature maintained all day despite outside temperature of wide fluctuations. Note that the heating medium (Hot Water) was never above 175°. When required it was as low as 105°. With Steam 212° is necessary whenever you want any heat.

erformance such as is illustrated in the t is possible only with hot water systems.

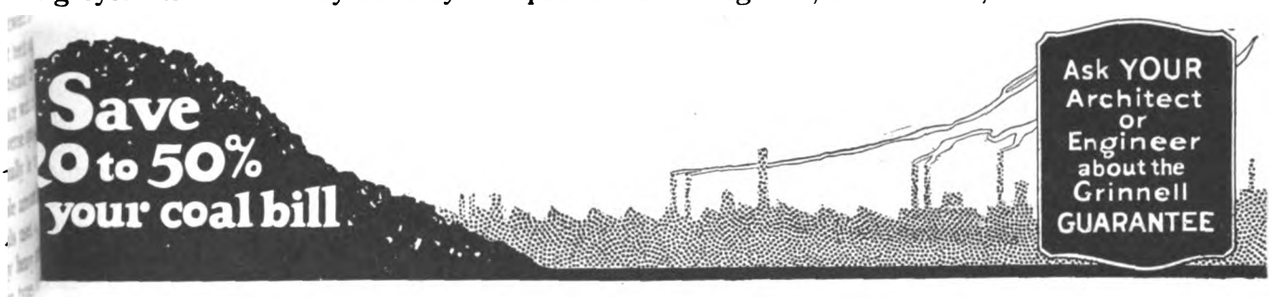
et many manufacturers go right ahead, lly wasting thousands of dollars installing ng systems which may or may not prove satisfactory, without even making an attempt to get the facts as a basis for comparison.

You recognize the need of better performance in heating your factory; and you are entitled to expect it—no matter how large your plant or how unusual its operating conditions.

There are six important reasons why manufacturers have never learned all the facts about Hot Water Heating economies.

You want to know these reasons. You ought to know them.

They are too technical to explain here. Ask us to write you about these reasons. They will surprise you. They will show you why the Grinnell plan of installing heating systems on a Guaranteed Performance basis is the only logical way to attack this problem. Your Architect or Engineer will tell you how this guarantee dovetails in with his specifications. Address any inquiry you wish to make of us to Grinnell Company, Inc., 307 W. Exchange St., Providence, R. I.

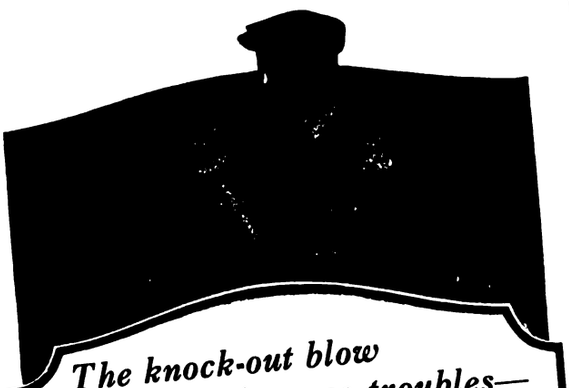


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(*Continued from page 66*)

be remembered that a lighter grade of lubricant will often last longer and yield better results under dusty conditions; the heavier grade of compound that would usually be used under clean operation can not be expected to maintain an efficient lubricating film in such cases. Rubber mixers are a typical example of the above. Here, as in some other instances, it may even be advisable to use a lubricant so much lighter that it will be practically fluid at operating temperatures.

To further appreciate the extent to which conditions of the above nature may affect the performance of a gear lubricant, it is interesting to note the several successive reactions to which the latter will be subjected. Essentially there are three distinct phases involved, i.e.:

1. When the point of the gear tooth comes in contact with the root of the companion pinion tooth.
2. Where both teeth are in contact adjacent to their pitch lines, and
3. Where the reverse of the first takes place as the teeth pass out of mesh.

If any sliding motion takes place at all, it is most likely to occur when the teeth first come in contact and as they become disengaged, the points of the respective elements exerting a more or less scraping action on the sides of the adjacent teeth. Therefore both wiping action and squeezing will be most apt to occur at these times. As the teeth become more and more engaged, however, sliding contact is replaced by rolling contact; in other words, we approach the ideal operating condition for gearing. Wiping or scraping off of the lubricant is therefore practically eliminated, but the squeezing out action still is possible, especially as maximum bearing pressures are encountered during the time the teeth are so engaged. In other words, wear will occur more rapidly at the points and roots of the teeth due to the sliding friction involved.

THE methods employed in the application of gear lubricants will depend largely upon the service involved. For example, the gears in an automobile transmission are usually bath lubricated; the smaller trains of gears in the front end of automobile engines, which often serve as sprockets for silent chain drives, are generally lubricated by the engine oil; the gears which drive the rolls on certain rubber machines may be either bath or hand lubricated; the gearing on excavating machinery is practically always hand oiled, while turbine reduction gears are often served by force feed. So we have a wide variety of conditions, each of which may require special consideration according to the design of the machine, the size and number of the gears and the products being handled. Certain of these latter will be of a perishable nature such as food stuffs, paper and textiles. As a result, any gearing involved must be so lubricated that there will be practically no chance of the gear compound splashing, dripping or being thrown onto these products. Others require little or no consideration of this nature and oftentimes, in such cases, even waste oils are slopped all over the machinery due to careless lubrication of the gears. Gear lubrication can be regarded as applicable to five distinct methods of operation, i.e.:

1. Where the gears run in an enclosed casing,

(*Continued on page 70*)

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What Self-Analysis Can Do

To or For { A Foreman, A Superintendent, A General Manager, A Treasurer, A President } *and for his Company*

Try it. Many progressive men who are working with the interest of their Company at heart, continue year by year along a definite path with their attention focused on specific phases, and allow opportunity after opportunity to make savings (stop losses) to go by, simply because they have not asked themselves the following question—"CAN'T I IN SOME WAY CUT DOWN THE EXPENSE OF HANDLING, REHANDLING AND RE-HANDLING MY MATERIALS?" The answer is so evident that the tendency is to simply do any one of a number of things; such as buy this, or buy that; or try out this, or that. Carry this SELF ANALYSIS further and ask yourself—"DO I WANT THE GREATEST POSSIBLE SAVING?" The answer is "Yes." Right here we believe you will agree with us in diagnosing a physical ailment, you consult a diagnostician and get the best specialist you can find to prescribe the remedy.

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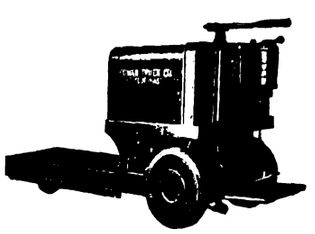


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(Continued from page 68)

out of contact with the bearing lubricant, being bath or force feed lubricated.

2. Where they run in an enclosed bath, the gear lubricant at the same time serving the bearings as is true in many reduction gear installations.

3. Where gears are entirely exposed, the lubricant being applied by hand.

4. Where the gears run exposed, but with their lower portions so encased as to render bath lubrication possible.

5. Where gears are entirely exposed, and subject to such dirty conditions as to render practically any lubrication inefficient, however refined the lubricant may be.

Where and when to use any specific grade of lubricant is, therefore, evidently oftentimes a problem. In general, however, for all methods of lubrication, except the second (as stated above), we will find that the more we adhere to the use of straight mineral, higher viscosity gear lubricants, the better will be the resultant service. Where bearings must be lubricated as well by the same product, naturally a lighter bodied or more fluid lubricant must be used. We must, however, remember that tooth pressures may often be so high as to exert quite a squeezing out action, therefore, a compromise will frequently be necessary in regard to how low the viscosity of the oil should be. Reduction gears in connection with steam turbine installations are a typical example of where a high grade straight mineral oil must be used for bearing service, but having such a viscosity at the operating temperature in the gear case as to serve at the same time as an effective gear lubricant.

The type of lubricant is therefore very essential in the obtaining of proper gear lubrication. On the other hand the actual application is of almost equal importance. For example, where pans are furnished for bath lubrication, they should be cleaned out at regular intervals, since any dust that may have gained entry will destroy the adhesiveness of the gear lubricant, tending to form a solid pasty mass which will not stick to the gears. Also where the gears dip in a bath of lubricant, this bath should be just deep enough to cover the lowest teeth.

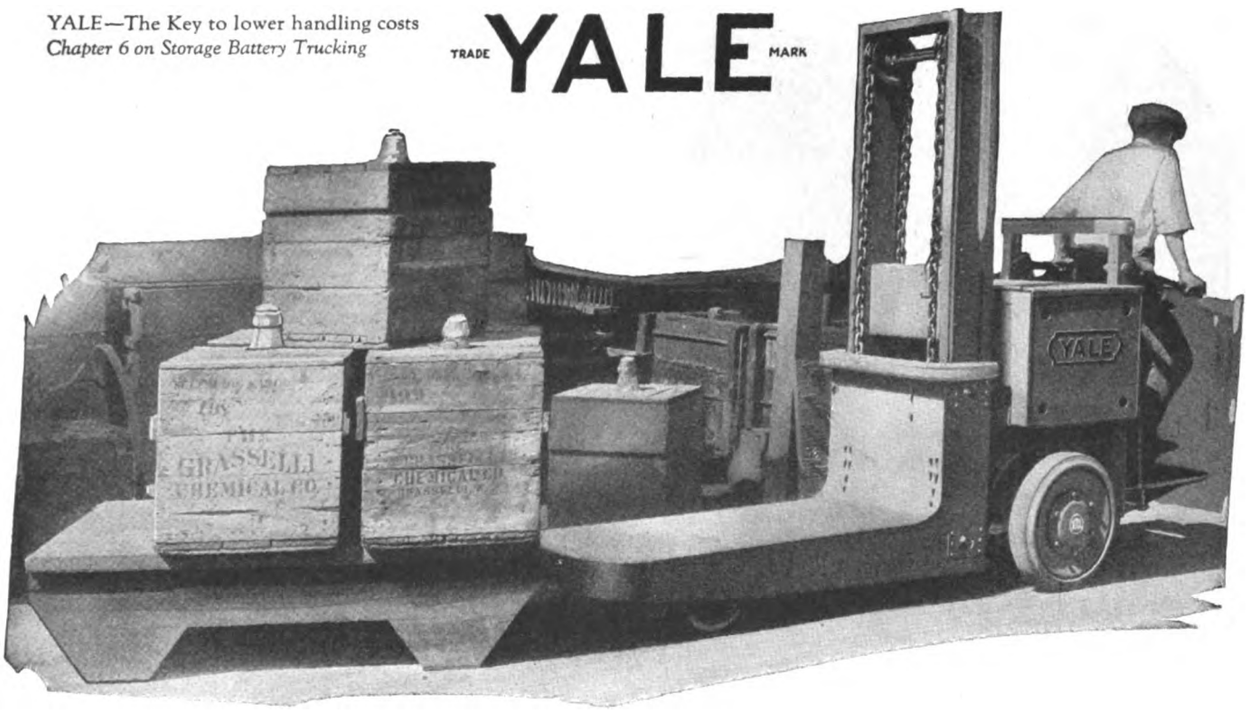
When the lubricant is applied by hand, it should be slightly heated to reduce it to the consistency desired, and painted on the gears with a short brush, or poured on from a dipper as the former are slowly revolved towards each other. Preferably pouring the lubricant on in a fine stream is the easiest, most economical and most effective method and is advised wherever possible. Gear lubricants should be applied to open gearing in small quantities and relatively frequently, rather than in considerable volumes and at longer intervals. Thus there will be less danger of gobs of lubricant being thrown off by centrifugal force, to possibly contaminate the products passing through the machine.



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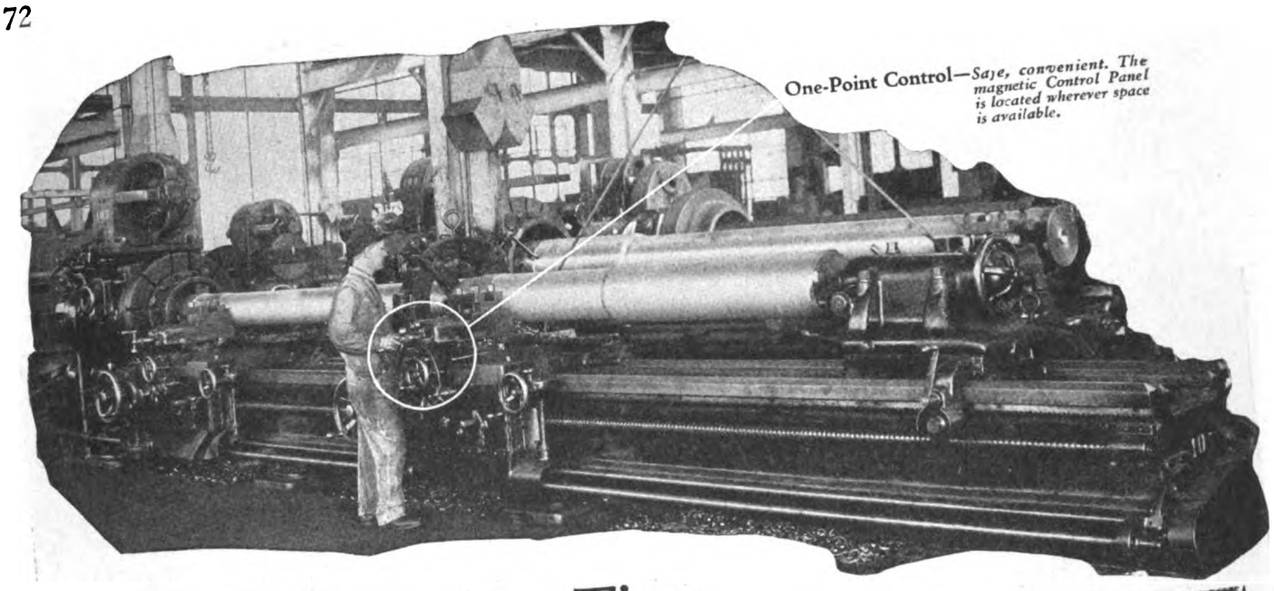
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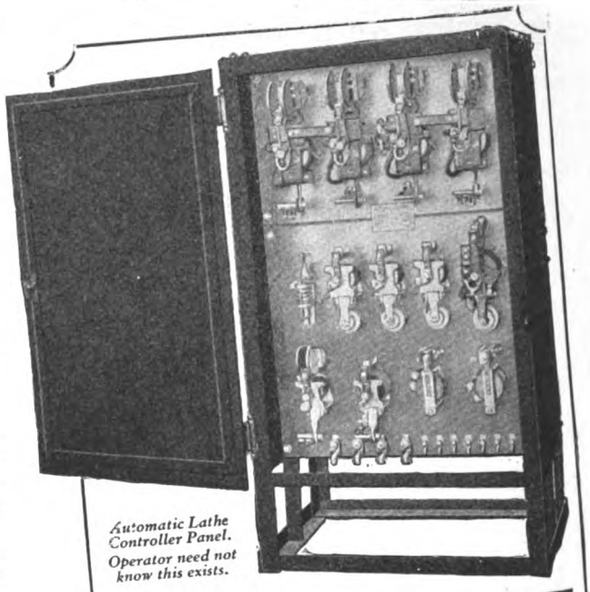
In addition the Cutler-Hammer engineers have developed an ingenious protective relay—the C-H Vibrating Relay which acts as a master brain in controlling the cutting speeds, and safeguarding the tool and motor.

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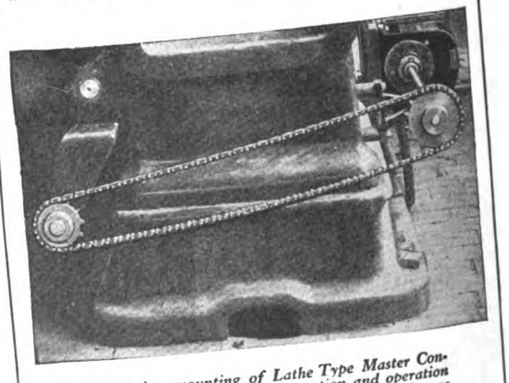
The automatic Overload Relay makes unnecessary the use of friction clutches or other devices to protect the machinery. The Relay gives the protection required, saves the machinery, saves time—eliminates fuse troubles and expense.

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Illustrating mounting of Lathe Type Master Controller on back of lathe. Connection and operation are through chain drive from spline shaft which runs to apron. The operator's control handle governs the motion of the spline shaft.

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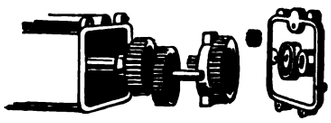
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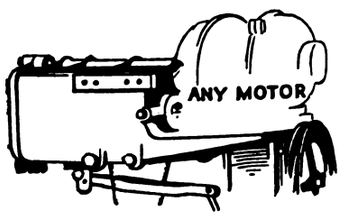
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No delicate parts.
Skilled mechanic not required.
Disassembled without removing hoist.

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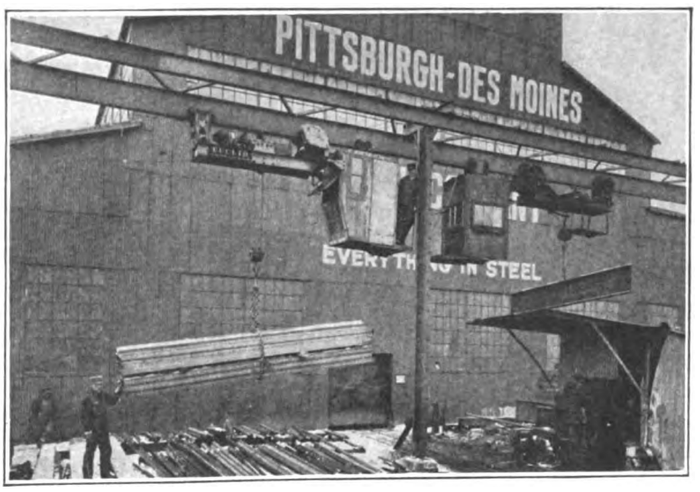
All gears wide face—coarse pitch.
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Parts enclosed in oil bath.
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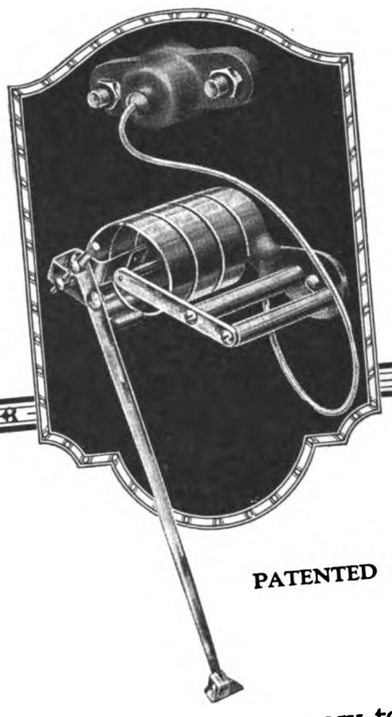
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Note the extreme simplicity of the Foxboro Improved Helical Tube Movement.

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It will not fatigue, split, leak or crack even when subjected to excess pressures that carry the pen way beyond the outer edge of the chart.

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THE COMPASS OF INDUSTRY

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What Is the Best Type of Roof?

(*Continued from page 17*)

vided with a monitor for light and ventilation.

Often there are monitors of great width, their roof being supported by a truss. This allows convenient space for crane runways, and the height of the monitor provides clearance for the crane above the working floor. Some architects design a roof of peculiar form by continuing one side or pitch beyond the ridge and above it and then joining this false ridge with the other slope by a row of sash standing at an incline of three inches per foot away from the vertical. This one-sided monitor constitutes a sort of sawtooth roof with "A" truss framing, and if the sash are placed on the north side of the building, they act just as the lights in a sawtooth roof and avoid direct sunlight. In any position, however, they act as ventilators.

Instead of putting the monitors at right angles to the trusses supporting the roof, they may be set parallel with them and are formed by the trusses themselves. This arrangement does away with the superfluous space under the trusses and is known as the "high and low bay" roof. Flat topped trusses are set transversely to the length of the building. The roof in the first bay at the end extends from the end wall to the truss and is on a level with the lower chord. Between the first and second trusses, the roof is carried on the top chords of the trusses, and between the second and third trusses it is at the level of the lower chords, thus alternating for the entire length of the building. In the vertical face of each truss glass sash is placed and thus every other pair of trusses is a monitor with glass sides.

A common form of "flush" skylight is set with the glass close to and parallel with the surface of the roof and acts as a window much more effectively than as a ventilator. They can only be considered satisfactory on roofs having considerable slope, as otherwise with their low set frames, flooding during heavy rains or from melting snow is inevitable.

Another type is a standing skylight, and there are several designs for arranging the glass in sash extending above the roof. Usually the top is shaped like a hip roof and the glass is set in light wood or metal frames. They also may have wall sash, like monitors, frequently arranged for affording ventilation. Where there are elevator shafts, light courts and stair-wells, these skylights are very satisfactory.

A design of roof frame used in large armories and formerly standard for railway terminal stations is occasionally employed in industrial buildings. This is the arch, of which there are two varieties. One of these comprises a curved truss of steel or wood and having both the upper and lower chords arched and nearly parallel with each other. The web members are arranged very similarly to a Howe truss. A steel rod, in tension like a bow string, joins the lower ends of the truss, and thus takes care of the thrust. This type may be used for large spans, even more than one hundred feet.

Another design, built up of light, laminated, wooden members, has the upper chord arched and the lower flat, forming a segment of a circle. The latticed web members of the truss may be of one or the other of several systems, in some cases the design being patented. Sometimes, but not usually, this style is used for a one hundred

(*Continued on page 78*)

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an adaptable material for important units

WHERE a unit of your product must have insulating properties together with mechanical strength and the ability to withstand heat, use Fibroc.

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Write for detailed information and a sample of Fibroc for experimental purposes

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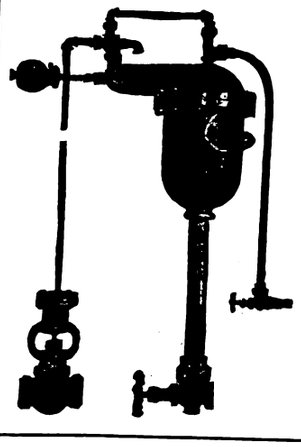
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1—Protect yourself against boiler explosions.
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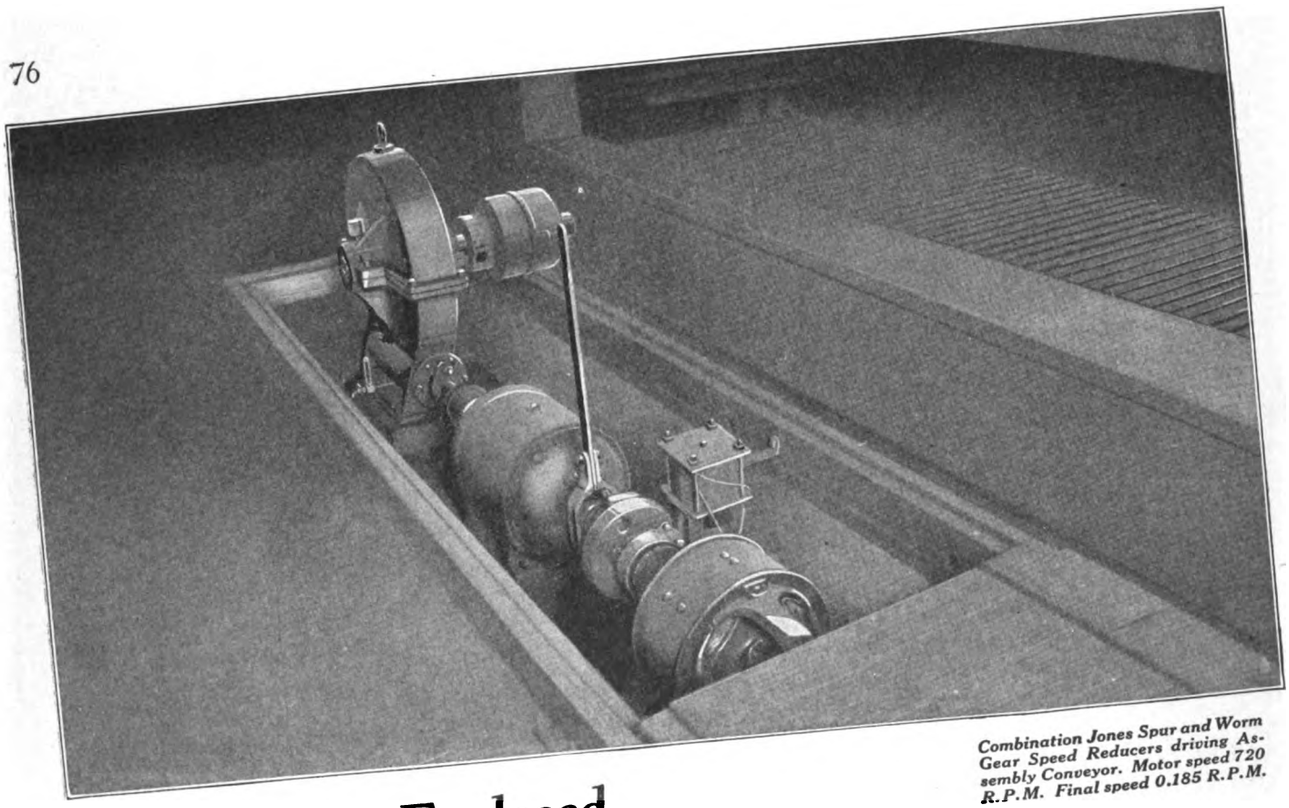
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Where Jones Enclosed Speed Reducers are used

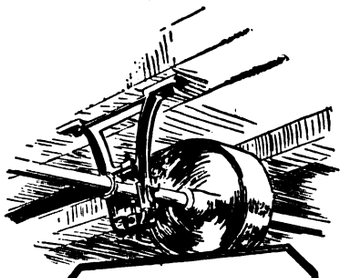
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"To obtain the same records by the card system would require at least twice the clerical help. The greatest advantage next to the facility obtained in record keeping is the reduction in our stores inventory made possible because of the visible record. When one considers we have practically 5000 numbers in our stores this saving is better appreciated. The McCaskey Register one writing system is the best system we know of for handling stores as we do here. We would not be without it."

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(*Continued from page 75*)

foot span, but is not in favor with the fire underwriters by reason of the employment of small size lumber in its makeup.

Sawtooth skylights are a series of parallel, triangular skylights having their ridges set in an east and west line and with glass on the north side, so as to receive no direct solar rays. At an angle of 75° slope, the glass is more effectively placed than if vertical. This is done with reference to the latitude of the location and is based upon the sun's deviation from the meridian at the time of the summer solstice, June 20-21. Practically, the sun does not shine directly in, except for a short time in the early morning and late afternoon hours in the beginning of summer. The light coming from the north sky is of very uniform quality.

These sawtooth roofs also have good ventilating qualities if movable sash or ventilators are put in on the ridges. Steel, wood or concrete may be employed in their construction. For support, it is common practice to rely upon a row of columns under each valley, spaced from sixteen to twenty-five feet apart. By using I-beams of proper depth, wider spacing may be secured.

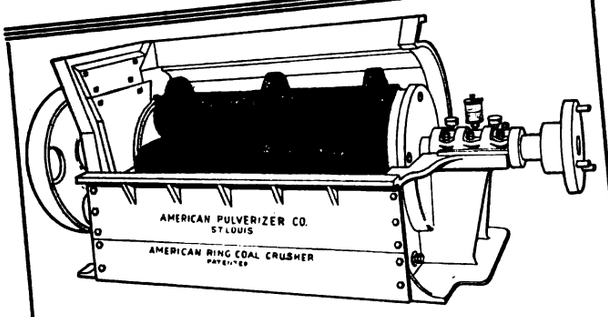
Several plans are effective for obtaining a clear floor space where the sawtooth construction is to be put in. Sometimes a Howe truss is set transversely below the sawteeth, but owing to the space occupied by the depth of the truss, this idea is unnecessarily costly. A Howe truss may be put in back of the glass in a perpendicular position or it may have the same slope as the glass. It is adapted to spans of not more than sixty-five feet.

The "Super-Span" system of trusses, developed and patented by the writer, and seemingly the most economical method of getting large sawtooth spaces free of columns, employs both longitudinal and transverse trusses. A Howe truss, placed behind the glass and correspondingly sloped, gives longitudinal support to the roof for a space of sixty-five feet. At sixty-five foot intervals, these trusses in turn are supported by a transverse truss of the same depth, whose bottom chord is on the level of the valleys and whose top chord extends outside the sawteeth connecting their peaks one to another in groups of two, three or four. The web members of the transverse trusses are the structural members of the sawteeth and they are like a bridge truss except that the angles of the web members are not equal in each pair. This will be apparent by reference to the accompanying illustrations. This transverse truss can be made of one hundred feet span, so that buildings of that width can be provided with roofs without using any columns, no matter of what length (measured parallel with the glass). For buildings wider than one hundred feet, the column spacing is sixty by one hundred feet.

Flat roofs and those with valleys where water may accumulate, such as those on sawtooth buildings, must have a surface composed of materials absolutely impervious to water. For making a watertight covering in such cases, it is usual to apply pitch or asphalt, put on while hot, with layers of paper or felt between each of several coats, and protected with a top surfacing of crushed stone or slag.

The use of pitch or of asphalt depends on the particular case. Pitch will melt at a lower temperature than asphalt and under the rays of a hot sun will soften and run down the slope of a roof unless protected by gravel

(*Continued on page 80*)



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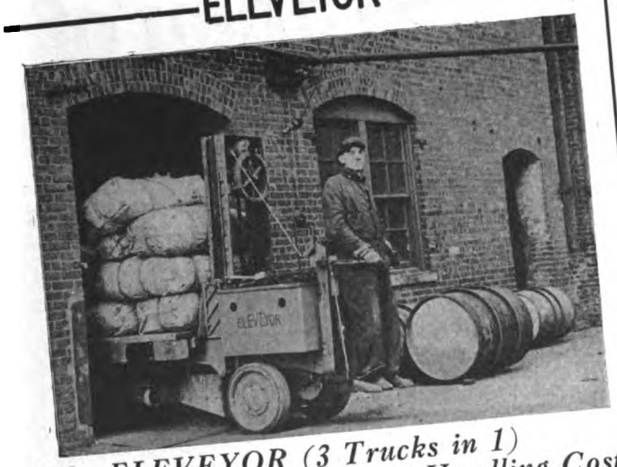
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(*Continued from page 78*)

or slag. This is unnecessary with asphalt, although on sawtooth roofs gravel is often applied, with the incidental advantage that it gives a lighter color and so reflects more light into the adjacent skylights. As between gravel and slag, unless color is the deciding factor, it is simply a question of cost or availability. The webbing used is felt paper impregnated with pitch or asphalt, or asbestos treated with asphalt.

Prepared roofings laid from rolls with a cemented lap are usually made of these same materials. When properly put on they are about the same as a built-up roofing, but tightness is dependent on a single mopped joint in one case, and on perhaps a half-dozen such joints in the other. Roll roofing is adapted to sloping surfaces where the joint is not subjected to water pressure.

There are many materials employed to cover the spaces between the trusses and purlins of the roof structure, and we must now consider these. Wooden planking is in common use. While combustible and liable to decay, it is inexpensive and a poor conductor of heat, and it therefore reduces condensation and aids in conserving heat. Treated with a preservative, its life and fire-resisting properties may be increased at moderate expense, and it will withstand many chemical fumes that soon destroy steel or masonry.

Where the rest of the structure is of concrete, this material may be used for roof construction. Ordinarily, better adapted to flat roofs, it is also widely used for the monitor and sawtooth types. In situations where the air is very moist, concrete requires insulation of some sort to prevent condensation. Several styles of construction have been developed, varying from beam-and-girder and flat slab system to those using tiles made of gypsum, burned clay or metal for the purpose of reducing weight.

Gypsum is obtainable in roof tiles and in large slabs that can be laid directly on angle irons or inverted "T"s, or it may be cast in place with metal reinforcement very much as concrete. In fact, gypsum combines many good properties of both wood and concrete. Non-combustible and permanent and readily handled, it is also a non-conductor of heat and is frequently preferable to wood, except where exposed to acid fumes. Its cost is slightly higher than that of wood.

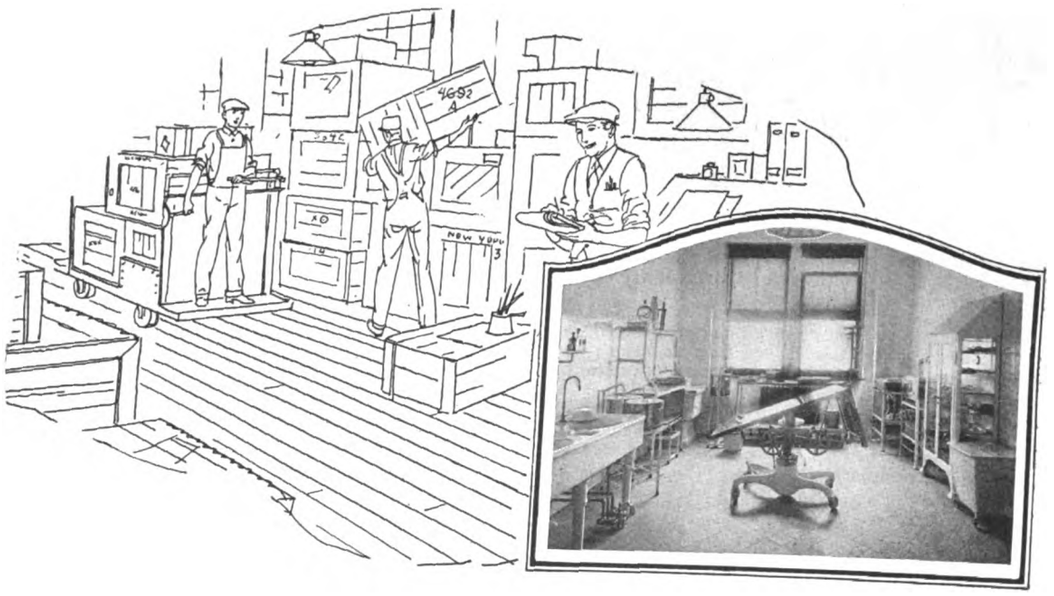
Various metals are available. Corrugated galvanized iron is frequently chosen for temporary, low-cost buildings, but unless a high grade, refined iron is purchased, it does not last long and is very subject to corrosion from chemical fumes. Possessing high heat conductivity, it makes a building hot in summer, cold in winter, and will cause excessive condensation if the air has much humidity. Galvanized iron is obtainable, however, with both surfaces and the edges covered with several layers of asbestos paper cemented to the metal, which largely obviates these objectionable features.

A material rather new in our domestic market is corrugated zinc. Fairly high priced, its permanence and consequent low maintenance cost render it well worthy of consideration. It is more lasting than galvanized iron, rust proof and but slightly liable to corrosion; but like iron, is a very good conductor of heat.

A very permanent material and one that is an excellent resistor of chemical fumes is asbestos. Corrugated sheets and flat asbestos boards are sometimes used. As

(*Continued on page 82*)

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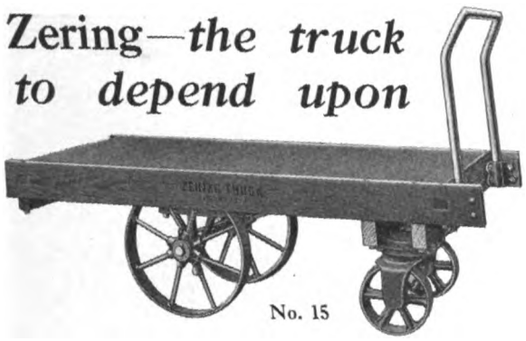
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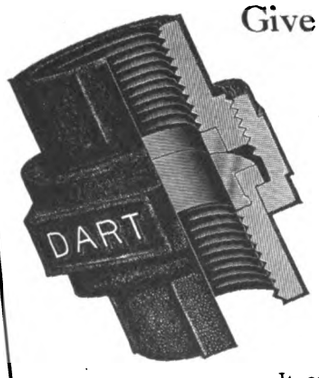
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Providence, Rhode Island

(*Continued from page* 80)

the sheets are very thin, their insulating qualities are not good.

For roofs of rather steep pitch, concrete tiles have been brought out and are obtainable in fairly large units. Where condensation and leakage of air are not important factors, such as on a boiler house, they can be placed directly on the steel framework of the roof.

Wire glass, made in corrugated sheets, can be used as a roofing material. It is permanent and resists all kinds of corrosive influences and its translucence makes it valuable in certain locations. It is expensive, however, heavy and brittle, and a good conductor of heat. It will not shatter under impact, but of course will crack; and such cracks, unless at once cemented up will let in water. A flexible setting has recently been developed for the purpose of allowing for expansion and contraction as well as wind pressure, which would make it possible to construct a building of glass walls and roof, if such an undertaking were warranted.

Many of the materials mentioned need protection of some kind, especially on flat roofs, where water may stand for some time. On steep roofs, of course, no such precaution is required, as the water runs off readily. Shingles, slate, tile and metals, are able to shed water, relying upon an overlap to prevent rain from working through. Wooden shingles are hardly ever used, but those made of asbestos cement or of felt paper with a stone-chip surface are highly favored. The use of these or slate or tile is determined by the consideration of cost, permanence and appearance. On pitch roofs, metal has been quite extensively employed, the sheets being crimped together at the edges (vertical seams frequently being left standing) and having all flat seams soldered. Copper and zinc are in considerable use, the former being chosen for its permanence, although some opinion tends to a preference for zinc as being equally durable and less costly. While tin is much the cheapest, it must be frequently painted to protect it from corrosion.

Condensation on the under side of a roof, referred to before, occurs where there is a high degree of humidity in a building and in many cases it is necessary to put a layer of insulating material between the structural roof and the outer surface. Prepared cork, fibrous mattings and compressed fibre boards are used.

Where condensation forms on monitor and skylight windows, it can often be diminished by using double glazed sash. Wherever any drip may damage goods or machinery, as for instance in a silk mill, it may be necessary in extreme cases to install gutters to carry off any water that may collect.

Leaky roofs should not be tolerated; nor is it necessary to do so. They are oftener to be blamed on the architect who does not specify in sufficient detail as to material or mode of application, or upon the owner's insistence on low first cost, than upon the contractor who puts the roof on the building. It is simply a matter of using the proper materials and of putting them on properly to obtain a satisfactory roof. After that, roof worries can be reduced to regular inspection and slight repairs for many years.

Flashings, suitably designed, must be placed at all changes or interruptions in the plane of a roof. Flashing should be of permanent and non-corrosive material. It must be set flexibly, especially on wood plank roofs, so that as the wood shrinks, it will not tear the flashing.

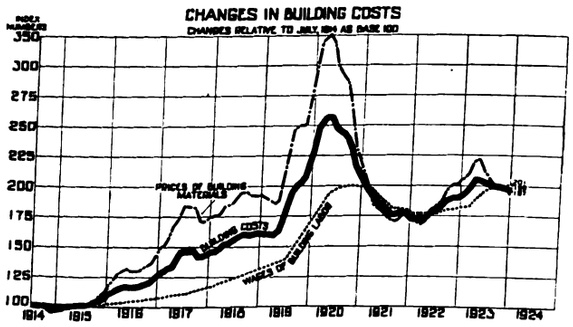
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Finally, flashings should be carried above the highest point to which water might collect before overflowing in case the drains are stopped up or are too small. They should therefore be carried up as high as the "crown" of a flat roof, or to the level of an emergency overflow, such as "weep holes" extending through the parapet walls.

A very important detail of this subject is the removal of rain water from a roof. On roofs of steep pitch, this takes care of itself. Gutters are placed along the eaves to avoid washing out the ground underneath, to prevent the curtain of water from the roof being blown against walls and windows and to get the water away from the building that might otherwise leak into the basement.

It is not so easy to care for the water that collects in valleys and on flat roofs. No hollow spaces must be allowed on the roof unless provided with a drain, and the inlets to these drains must be sturdy, properly put in, and so designed that they will not become clogged by ice or any foreign substance. The drain pipes should be carried down inside the building to avoid their freezing and should be large enough to carry off the largest probable rainfall.

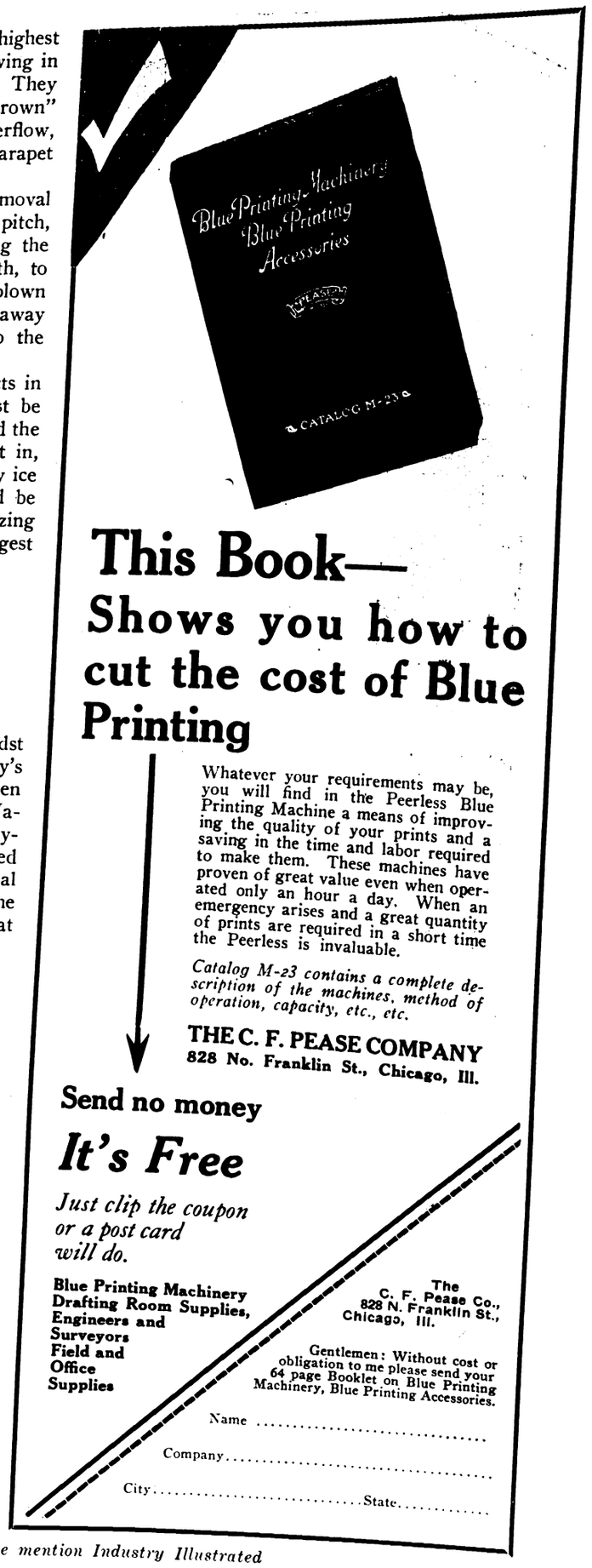
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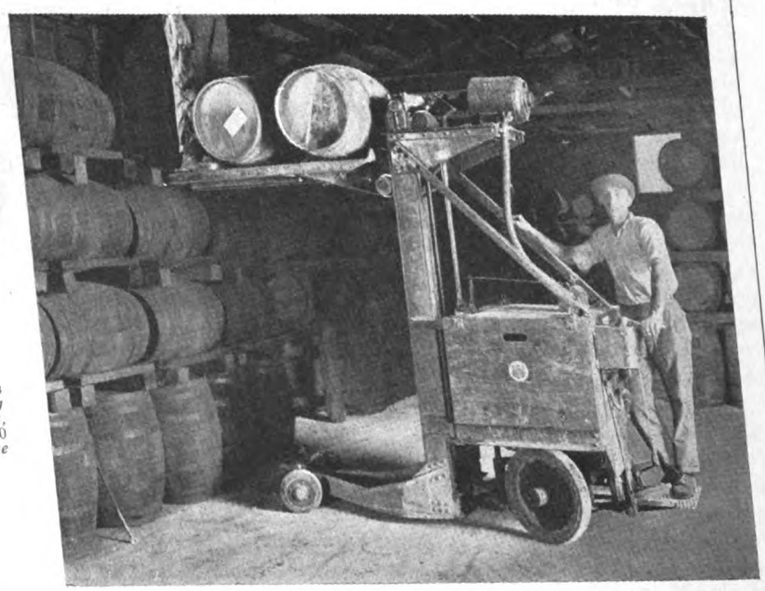
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How They Solve Their Packing and Shipping Problems

(Continued from page 26)

building who makes out a bill of lading in quadruplicate. Freight rates are then computed and the bills-of-lading are then distributed. Lists are made of all bills-of-lading issued and sent to the transportation department. The second copy of the bill-of-lading is given the railroad representative, who makes out duplicate waybills from it, the original of which is delivered to the railroad with the freight and the copy being filed in the local freight office. The third copy of the bill-of-lading is filed according to destination, and the fourth copy is sent with a memorandum of shipment to the consignee.

After the bill-of-lading has been made out, the order is priced and then passes to the billing division where a memorandum of shipment is made out. One carbon copy of this memo is kept in file while the original, made out in hektograph ink, constitutes the foundation for the billing and other records. From this master copy is made one copy for the district sales office, one or more copies for the customer, and the master copy is sent the accounting department. Additional copies of the memorandum of shipment are made, one being sent to the district office and another being attached to the bill-of-lading for forwarding to the consignee, the memo first being checked against the bill-of-lading. The extended bills, having been numbered, are mailed or otherwise distributed. The order is then filed.

This routine, however, applies only to shipments made from stock. In case material has to be made up, instead of being obtained from the warehouse it has to be manufactured in the factory. The shipping department receives all orders and distributes copies to the various manufacturing sections. The originals are retained in the shipping department file and the progress of work in the factory up to the point of shipment is noted on the card record. When material is completed in the factory it is then delivered to the shipping department, the routine functioning from then on as already outlined.

But there is another side to the operations of the shipping department whose importance cannot be underestimated. The packing and loading of large apparatus for domestic shipment often presents difficulties owing to weight or clearances, and in many cases special cars are necessary. On the other hand, the smaller pieces usually need only to be carefully boxed to insure their safe delivery to any point in the country. With foreign shipments the problem is entirely different. The shipping department must inform itself of the methods of transportation to be encountered on the journey and of the climatic conditions of the country to which the apparatus is shipped.

As an example, electrical machinery for the west coast of South America must be packed differently from that destined for the east coast. Machines for the west coast must be "dismembered" into numerous small packages of comparatively light weight, because there are no wharves, piers or docks worthy of mention on the entire west coast. Besides this, a burro cannot carry up into the Andes Mountains a package weighing over 170 pounds, while a mule's limit is 350 pounds. Electrical machinery, therefore, must be disassembled before being sent on such a journey.



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are afforded by the Cambridge instrument shown above. This feature makes it the logical choice for the busy boiler room. By showing four CO_2 percentages on one chart time is saved and the possibility of errors in reading is greatly reduced.

Cambridge Electrical CO_2 Recorders and Indicators are extremely accurate and rapid in action and practically fool proof. They are entirely electrical —no chemicals to renew—no glass or rubber parts to break or wear out. These rugged instruments may be installed any distance from the flue. Maintenance cost is very low.

Other Cambridge Instruments—Electric Distance Thermometers, Thermo-electric Pyrometers, Optical Pyrometers, Pressure Recorders, Draft Gauges. Write for List No. 157F, containing interesting data.

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MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK
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Shipping department experts know how to pack machinery to defy breakage, rain and moisture. In some cases where machinery is destined for the west coast of South America, the boxes are lowered into lighters to be taken ashore. The size and weight of packages must be so limited that the men handling the derricks are able safely to land the machinery in the lighter without running the chance of crashing through the bottom into the sea when the lighter rises on the crest of a wave.

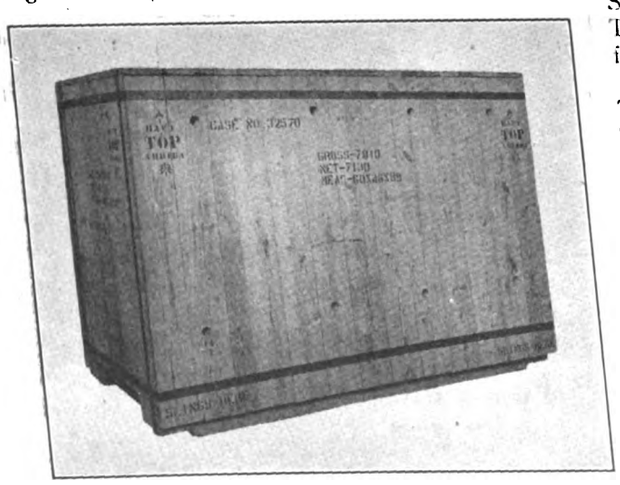
In India, crude trucks drawn by oxen carry loads as heavy as three to five tons and the elephant can haul ten tons. In one installation of American machinery, one year was required to carry the apparatus 250 miles into the interior by elephants.

Electricity is needed in the frigid zones as well as in the torrid zones, and the dog of the Eskimo is the accepted means of transportation in these northern latitudes. One thousand pounds is the limit in weight of each package in order that it may be effectively handled by a standard dog train. So well does the shipping expert comprehend the peculiar local conditions, that special horns are provided on each package to assist the natives in lashing the packages to the sleds.

To illustrate the development of the art of shipping, it might be well to mention that a special train was necessary to transport the first great turbine built from Schenectady to Chicago in 1902. This was a 5,000 kilowatt machine as contrasted with machines of over 60,000 kilowatts capacity which are handled today.

The shipping department has available special cars of unusual strength, with increased depth reaching down to within a few inches of the rail and otherwise adapted for the peculiar variation in size, shape and weight of modern electrical machinery.

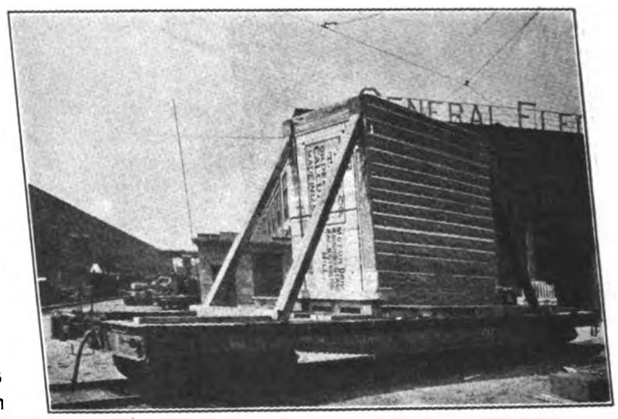
The art of fastening large pieces of apparatus to a freight car has been developed to a high degree of perfection. In one wreck on a western railroad, the car containing General Electric apparatus was upset. When the wreck was cleared, it was found that the platform of the car and the apparatus were still a unit, the platform having left the trucks but remaining fixed immovably to the apparatus.



Note the strength, and the attention to important details, in packing this welding machine for export.

In the shipping department boxes are made and nails driven by electricity. Over a ton of nails is used every day for this purpose. Over eighteen million feet of lumber is used every year and almost 2,000 miles of band iron to strengthen the boxes. About twenty million square feet of wrapping paper, waterproof paper and rubber-covered lining are also required for a year's work.

Many instances could be given where single turbines have required twenty-three separate cars for shipping, where special cars carrying 100 tons each have been utilized and of apparatus so nicely poised and balanced on a car that clearance between the sides of tunnels or bottom of bridges has been figured out to a half-inch. In such calculations as these, it is necessary to abandon the use of wood for boxing, substituting sheet metal to obtain a covering thin enough to avoid crashing into bridges or scraping the sides of tunnels, as either occurrence would probably wreck the entire train.



This well-protected Armature is on its way from Schenectady to far off India.

In the case of shipments for France, Japan, and, as a matter of fact, most foreign countries, the bridges and tunnels have smaller capacities than those in the United States. Conditions in South America are the same. The usual method of packing, skidding, etc., must, therefore, be altered in such cases.

The loading of cars must also be made permanent. The creeping of the load on a car must be prevented. The bumping and rolling of a railroad train has been found to loosen the struts and braces unless the work is well done, and occasions have been known where the trains have been wrecked, bridges damaged and tunnels jammed with a tangle of machinery, locomotives and freight because a packer did not know his business. One of the means of preventing shifting of the load on a railroad car is to load the car uniformly, not only longitudinally, but laterally. The struts and braces are placed with great skill to prevent a concentration of the load at the end, the center or on either side of the car.

In an effort to keep machinery in an upright position throughout an entire voyage, large black arrows are painted on all four sides of a box with the word *Top* placed permanently near the head of the arrow, as well as the French word *Haut* and the Spanish word *Arriba*.

Expert packers have no difficulty in protecting machinery from rain and snow, wind and heat or from the mist on the sea. The real study, however, has been to overcome the accumulation of moisture on machinery due to humidity, especially in the tropics. Rain and snow are excluded by tar-coated building paper strengthened by mosquito netting. This latter is useful in adding strength to the tar paper and serves the purpose admirably.

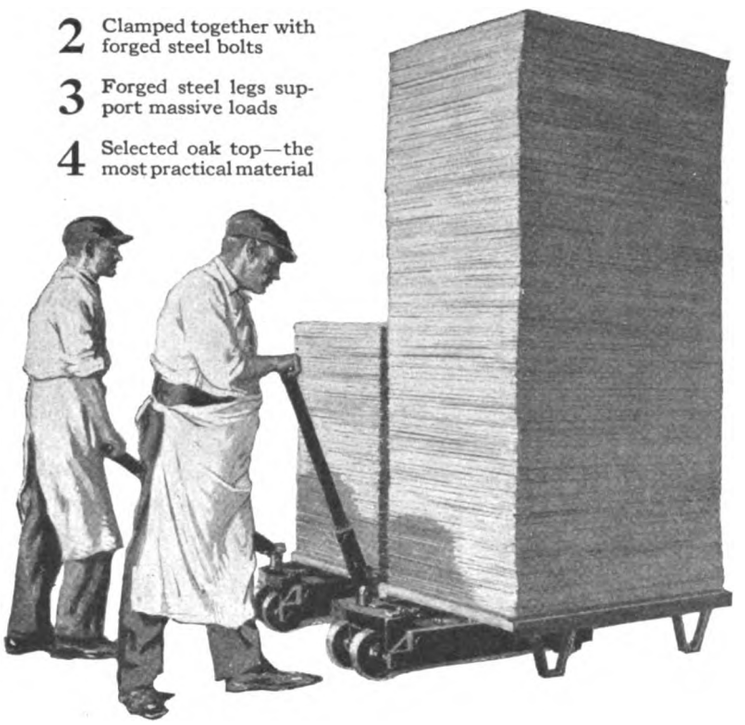
(*Continued on page* 88)

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1. "Steel-Bound" the full length
2. Clamped together with forged steel bolts
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Before lift trucks were invented, materials were handled more than hauled, and even today, where old style trucks are still in use, handling costs constitute the greater part of "hauling costs"

The only genuine "Steel-Bound" Platform is made by Stuebing. All others are infringements and are liable to prosecution under Stuebing patents

In the plant of the U. S. Playing Card Co., at Norwood, Ohio, are 1,000 "Steel-Bound" Platforms. They are busy every hour of the working day, loaded with *tons* of cardboard as it moves through the plant in course of manufacture.

Why does the U. S. Playing Card Co. use Stuebing "Steel-Bound" Platforms?

Because they know from experience that these steel-sheathed "gluttons for punishment" stand up and deliver under all kinds of use and misuse.

They made long, hard tests with various platforms in order to determine upon the *one platform that would save them the most money.*

And 1,000 "Steel-Bound" Platforms in use, to date, is pretty good proof that they have made a decision!

If you want to make all the saving possible, with *your* material handling equipment, specify Stuebing Lift Trucks and Stuebing "Steel-Bound" Platforms. Write today for a copy of our new 36-page catalog.

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8000 Factories Use Meeco Coolers



FIG. 629

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MEECO COOLERS are backed by nearly twenty years' experience in design and manufacture. They naturally embody many unique and exclusive features:

The Keith Sanitary Bubbler is standard equipment on all MEECO COOLERS. This bubbler is automatically, internally regulated so that a steady bubble may be maintained at a fixed point, no matter how the water pressure may vary. The adjustment of this permits fixing the height and force of the stream so as to prevent placing the mouth in contact with the bubbler. The size of the stream is just right, not only for good service, but for economy of water. The surface is convex and is automatically washed both before and after using. An upright or slant stream is optional.

The Meeco elliptical-shaped guard bowl and slant stream bubbler can also be furnished on all types without extra charge.

Meeco Coolers are heavily cork-jacketed on top, bottom and circumference in order to insure the utmost economy of ice. The coils are of the best quality ½" seamless, drawn, copper tubing, approximately 55 ft. long in 15½ coils. The water from the melting ice circulates freely around the coil in the quick cooling process, but does not come in contact with the drinking water inside the coil. The tank and coil capacity is scientifically designed to furnish water sufficiently ice-cooled to supply a continuous procession of persons such as is customary under practical conditions. The tank is constructed of heavy welded iron, galvanized after fabrication, and leakproof. The bowl is cast iron, pure white vitrified porcelain-enameled on the inside. The self-closing stop valve and other small fittings are of heavy brass, nickel-plated. The coolers are handsomely finished in two coats of olive-brown enamel, baked on.

There are 14 types designed for every need (Diagrams and complete details of construction will be mailed upon request). MEECO engineers, because of long experience in studying cooling requirements, are in a position to recommend the scientifically correct fountain for your particular requirements.

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(*Continued from page 86*)

For packages that go to foreign countries an additional covering of what is known as carriage cloth is used beneath the covering of tar-paper. This cloth is wrapped around the machinery itself and is held tight by strings and ropes that the machinery may be well protected no matter what position it assumes.

Various experiments were tried to overcome damage from rust produced by moisture in the air, or humidity. Special kinds of cloth and special coatings of tar were used and, in some cases, an entire metal box of zinc or lead was constructed and apparently hermetically sealed. All these methods failed, however. In one instance a motor was totally enclosed in a zinc tank and soldered tight. Two years later it was opened and three quarts of water were found in the bottom of the tank.

The problem was finally solved by making the boxes open instead of closed, in other words, breathing holes were provided to keep the temperature inside the box practically the same as that outside. After many experiments, a method was developed which solved the problem. Machinery was delivered free from rust but, in one instance, it was found that the mice on shipboard had taken advantage of the breathing holes in the boxes and had eaten off the insulation from some of the copper wires. From then on a wire screen or netting was tacked on the inside of each hole. Moreover, these holes must be far enough away from the top, bottom or sides to avoid the possibility of water washing into them.

As contrasted with these methods for large machinery, in the case of smaller and more delicate apparatus such as instruments which are liable to damage from moisture in very minute quantities, a pitch-covered canvas is used inside the box.

Each type of apparatus has assigned to it a definite box, of definite size and material, put together in a certain way, wrapped, tagged, etc., according to definite specifications, written down and often illustrated. There are over 700 kinds of boxes listed, and directions are included covering many different methods of loading flat cars, in which are specified the braces, struts, skids, etc., which should be used.

A summary of the ideals toward which the packing experts strive, in the order of their importance, might be as follows:

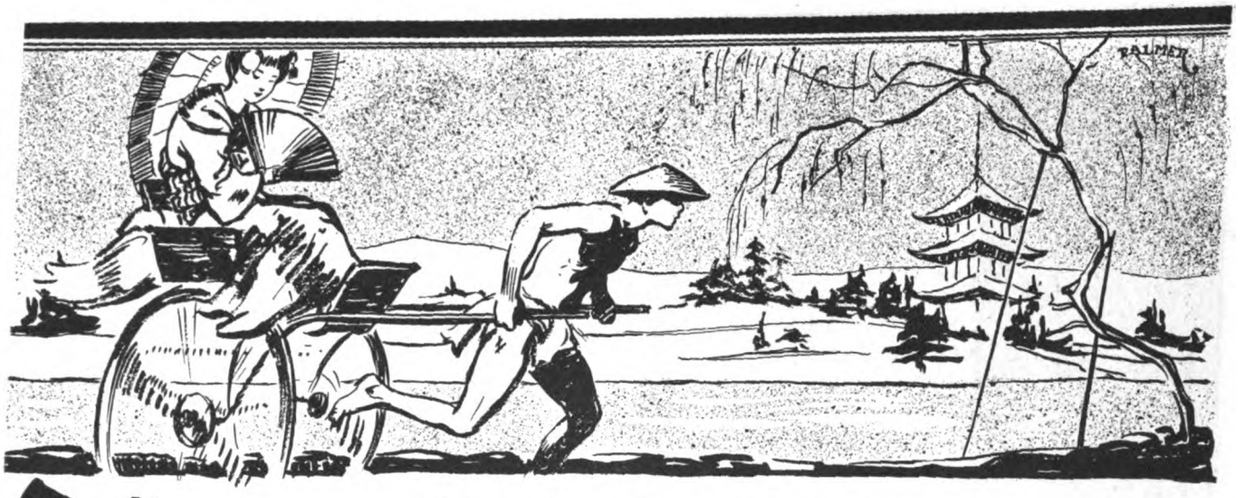
1. Get shipment to customer without breakage.
2. Get shipment to customer without rust or other damage by moisture.
3. Deliver shipment as nearly completely assembled as possible.
4. Deliver shipment as quickly as possible.
5. Deliver shipment with as small a transportation expense as possible.

Erratum Notice

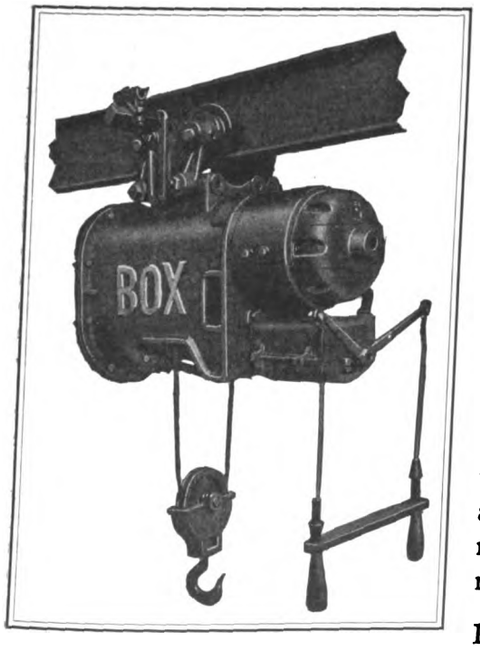
In our March, 1924, issue, photographs (Figs. 8 and 9) shown on page 19, illustrated the use of Van Dorn Iron Works' dump bodies on motor trucks. In the text on page 22, the impression was conveyed that one of these devices was mechanically operated, and the other hydraulically operated.

We wish to correct the statement on page 22, as both these dump bodies are mechanically operated.

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They Still Stick to Man-power



Alfred Box & Co., Inc., are also builders of the "Box Crane"—a standardized, heavy duty, Electric Traveling Crane in capacities of twenty tons and under; also builders of hand operated Traveling and Jib Cranes of any capacity. In addition, full line of Electric Hoists to five tons capacity—embodied in which are all the important features found in the "Load Lifter."

The Oriental idea regarding man power is not practical in this Country—yet we find many industries still allowing two, three, four, often five men to lift and shift parts, when *one man and an electric "Load Lifter"* would do the work quicker, better and cheaper than is possible with expensive and inefficient man power.

* * *

Every business which has loads up to 500, 1000 or more pounds to lift should be "Load Lifting" them—cutting costs, increasing outputs and doing a bigger, better day's work. The "Load Lifter" is small in size, but very powerful. It is of rugged construction—made to give years of hard service. All parts are enclosed and built with it are features that have made the name BOX on lifting appliances internationally known.

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New Jersey Foundry & Machine Co.
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Is There a Materials Handling Industry?

(*Continued from page* 36)

ing of straight run conveyors. The various types employed are *push bar elevators* for raising the boxes to the *gravity conveyors* that carry the boxes over the marshes from the plant, *belt conveyors* that transport the boxes the length of the dock, and the *crane* which carries the *spiral chute* which lowers the boxes into the hold of the ship.

The above equipment saves thousands of dollars per year and renders an economic service. It also permits quicker loading of the ships which receive their cargo from this plant. What is true here is true in other plants, but we wish to point out that in this installation only one class (although many types) of materials handling equipment is employed, but if the operation had been such that more than one class of equipment was required then it would have been necessary to work with more than one manufacturer and to employ an engineer conversant with all types and classed so as to avoid difficulty, as the manufacturers have not yet learned the full meaning of coöperation.

Because so many new uses are being made of mechanical equipment for the handling of materials, there is hardly a week or month that passes that does not bring forth a new development in order to handle a particular operation for one or more industries. Sometimes these devices can only be used on the operations they were designed for, but more often they can, by slight alterations, be used on many operations, and in different industries.

A device of the above character is shown in Figs. 11 and 12 and many installations of this bread cooling conveyor are now being made in both old and new bakeries. The writer is not aware that this device is being used for any other purpose than bread cooling but its construction and slow motion should suggest many uses. The discharge from one run to the other is clearly shown in Fig. 12 and the direction of travel is indicated by arrows. It will be noted that all the runs are carrying runs and there are no idle return runs.

The manufacturers who have been called upon to develop the most numerous new models of their equipment for special operations are the electric storage battery truck manufacturers and some of these models are shown in Figs. 15, 16, 17 and 18. This branch of the industry started out with one or two models or types of equipment, namely the electric lift truck and the electric tractor, but today each manufacturer has a number of models and these are only a few of the more recent ones.

The model shown in Fig. 15 is a heavy duty, revolving crane which is transported and operated entirely from electric storage batteries. The machine shown in Fig. 16 is a standard type high elevating truck equipped with a special platform, and finger gripping device for the handling of sheet stock. This truck attachment was developed for the handling of sheet tin, but there is no reason why it cannot be used for handling sheet metal, sheet paper stock, etc. The advantage of this truck over the ordinary high elevating truck is that with the attachment, the use of a number of skids or platforms is un-

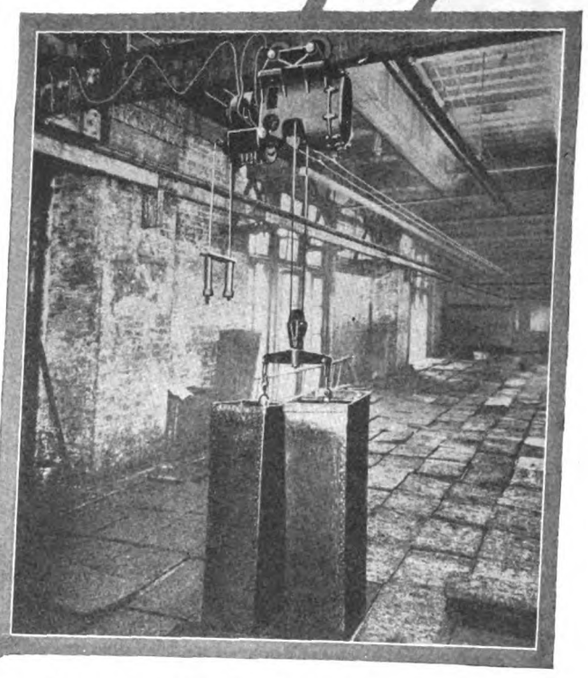
(*Continued on page* 92)

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The Type C-½ hoist will effect pronounced economies in the smallest or largest plant. Once in operation it replaces a surprising amount of labor, and handles your materials with a quickness and dispatch not otherwise possible.

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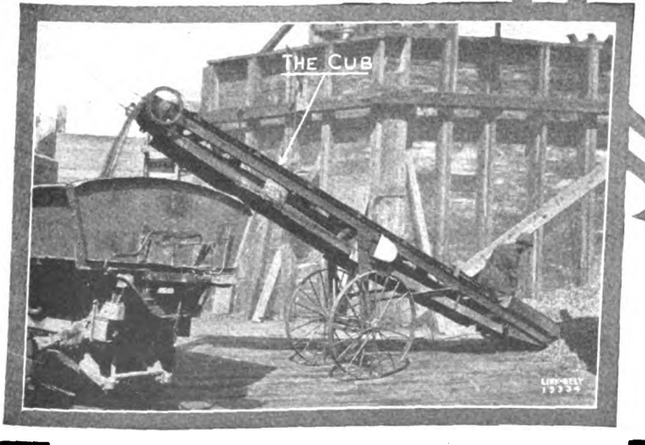
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The C-½ will lift 50, 100, 500, 1,000 pounds. It is built *to give* years of service. Anyone can operate it. The price includes complete equipment, ready for work when you get it.

Make Overhead Space Pay Profit

The Link-Belt Hoist saves floor space. It takes the shortest route from point to point. Handling confusion is eliminated. It is quick, unfailing in its operation and amazingly economical.

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The "Cub" Portable Loader

Handles any loose material—45 cubic ft. per minute, equivalent to the work of six or more men, to be exact.

Price $485 Complete

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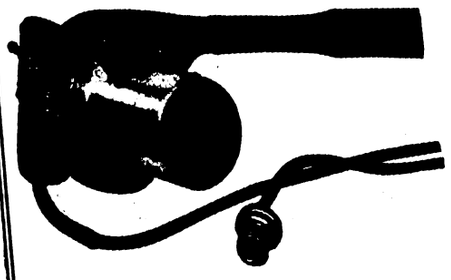
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(*Continued from page* 90)

necessary, for the placing of the materials on 2" strips as shown will permit the truck to pick up the load without rehandling. The truck shown in Figs. 17 and 18 is bringing out a new principle of picking up the load by getting around it instead of under it. When handling loads similar to that shown, this method of pickup has many advantages. Attention is directed to the simplicity of the adjustment on the lifting arms so as to permit the pickup of different diameter reels.

This indicates that it is the present manufacturers who should investigate all new handling problems and then adapt their present equipment to fit the job or else develop new equipment. The following of this practice will assure them of a continued business and will discourage the springing up of a number of manufacturers to build special materials handling equipment. Many new devices are offered to the present manufacturers and are turned down without due consideration and the result is that if the inventor has money or can interest capital he will produce his device by forming his own company. In this way a number of the present manufacturers obtained their start and because of their progressive spirit have added new developments to their original line and are now considered the best in their field.

It is therefore necessary for each manufacturer to be continually on the lookout for new ideas and new uses for his present equipment, either in its original state or with additions and alterations. Fig. 13 shows how a tiering machine manufacturer used the principle of his original equipment and fitted it into a fixed machine operation. Fig. 14 illustrates how a tiering machine, which was primarily built for piling materials, is now used for the loading and unloading of trucks.

When an operation such as the unloading and loading of trucks is considered important enough there is always a machine developed and patented to execute the work. To prove this we present Figs. 19, 20 and 21, which show the operation of a new elevating end gate. This device is a part of the truck and is driven direct from the truck engine. This feature means that the elevator is with the truck, whether it is in the plant, at the station, or on the road. Thus it is always ready to load or unload the truck at a moment's notice. The elevating operation is clearly shown, but Fig. 19 illustrates a use for the same equipment which presented itself after the machine was built and installed on the truck. The feature of being a power driven jack will add to the value of this device for the truck user.

At the first part of this article reference was made to the Automotive Industry and it will be noted from the illustrations that this industry is directly affected by the use of materials handling equipment. In fact a motor truck is one of the many pieces of equipment that would come under this heading, and it will be noted from Figs. 22, 23, 24 and 28 that this industry is already cognizant of the importance of adapting the equipment it manufactures to the many operations which it is called upon to perform.

Figs. 22 and 23 show a device which a large truck manufacturer is now building and selling to work in conjunction with his trucks. This machine is equipped so that post holes can be dug mechanically by using power from the truck engine, and the crane device simplifies the setting of the posts. The construction of pole lines

(*Continued on page* 94)

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Saves Money in Six Ways

1 Saves money because it saves steam. Being operated automatically by the expansion and contraction of a volatile liquid, the valve is closed promptly when the condensation has been discharged.

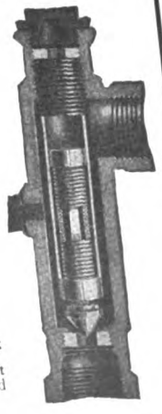
2 Saves money by keeping the line free from all condensate all the time. The Steam Trap Sarco drains condensate as soon as it forms.

3 Saves money by returning condensate to the hot well while still hot, instead of when cold from lying around, as in bucket traps.

4 Saves money because it requires no platform building, no supports, no pit-digging. Steam Trap Sarco is so small and compact that it can be installed at any point in the line, no matter how limited the space.

5 Saves money because it has no complicated parts to require adjustment, repair or replacement. It eliminates entirely all the levers, gauges, floats, stuffing boxes and other superfluous parts. It has only one moving part.

6 Saves money right at the start, because it costs but one-third as much as float or bucket traps.



You can try it out for yourself at our expense by taking advantage of our 30-day free trial offer.

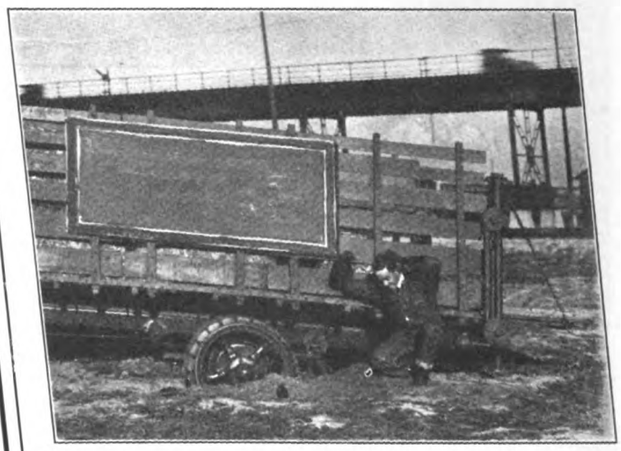
At any rate, send for Booklet R-7.

SARCO CO., Inc.
236 Broadway New York
Buffalo Boston Detroit
Chicago Philadelphia Cleveland
Peacock Bros., Limited, Montreal

(*Continued from page 92*)

for a telephone or telegraph system embodies a variety of work and especially on long stretches of country roadside which requires the transportation and maintenance of big gangs of men, and because men dislike this sort of labor, and speed is the greatest essential in repair and replacement work, a device as shown will materially reduce costs and bring about the desired results.

Another indication of the trend of the Automotive Industry, in regard to materials handling, is shown in Figs. 24 and 28, which illustrate a new type of motor truck that can be either electrically or gasoline driven. This equipment straddles the load and in this way eliminates rehandling. It has been found that one of these carriers operating in the plant of the Lamb-Fish Lumber Co., Charleston, Miss., replaced 10 mules and 10 men, which of course is quite an item. It was also found that the new carrier would handle from 150,000 to 200,000 feet of lumber in 10 hours, while the average for a team is 15,000 feet in 10 hours. The figures collected also show that a man and a mule handle on the average of



This is where the mechanism shown in Figs. 19 and 21 comes in handy.

800 and 900 feet per trip, while the power truck will average about 3,000 feet per load. The main feature of this truck is its ability to pick up long and unwieldy timbers, as shown in Fig. 24.

It is not only the automotive industry that is bringing out new types of equipment, but others are also entering the field with many new devices. Figs. 25, 26 and 27 show one of the latest developments in the mechanical driven conveyor field. This machine is new and novel and while still in a more or less development stage, it is being produced and sold. This device was evolved to supply the need of a conveyor, mechanically driven, that would be capable of operating around corners. To the writer's knowledge this is the only portable flexible power driven conveyor that is on the market at the present time. This is therefore a new departure, and a radical development. There are, of course, gravity conveyors and gravity spiral chutes which will convey materials around corners, but it is not always convenient or possible to use gravity as a means of locomotion and gravity will only convey the materials in one direction, while with a power conveyor it is possible to convey in both directions.

With this flexible conveyor it will be possible to trans-

(*Continued on page 96*)

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"LE" NORTHERN

The CRANE for Low Headroom

For low headroom, lean-to's of large factories and other places where the height is limited the "LE" Crane has been especially designed. All the outstanding features of NORTHERN Cranes—compactness, accessibility, ruggedness and efficiency is evident in this standard type NORTHERN Crane.

The Heart of the Crane—The "LE" Trolley

This is the most compact and most accessible trolley built. All gearing arranged in transmission form and entirely enclosed, short shafts, liberal bearings, hardened steel gearing. All bearings and gears are oil lubricated.

The "LE" Crane is built in 1 to 10 ton capacities—any span. Cab or floor controlled.

We can refer you to an installation in your vicinity. Write for a list of satisfied users.

NORTHERN ENGINEERING WORKS
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Lowest in Cost, on Basis of *Performance*

YOU expect to pay a little more, when you buy an Elwell-Parker Tructor. But that difference, slight as it is, buys features that you can get *only* in an Elwell-Parker.

This Company knows that such refinements cannot be successfully left out; Elwell-Parker is the oldest exclusive maker of electric trucks and tractors.

An Elwell-Parker user (name on request) reports that he is now overhauling, for the first time, a Truck purchased in 1913, or 11 years ago. *The average cost for spare parts for Elwell-Parker Tructors is only Six Dollars per month!*

Elwell-Parker excellence produces a Tructor lowest in cost on the basis of tons carried, miles traveled, or actual years in service. Get Bulletin 52 and you'll see why.

The ELWELL-PARKER ELECTRIC COMPANY

Cleveland Ohio

(*Continued from page 94*)

fer from one location to another such materials as boxes of all ordinary dimensions, sacks, kegs, pails, lumber, pig iron, bricks, slabs and all similar materials. This equipment can also be used for loading or unloading box cars or to simply stack materials to reasonable heights in warehouses and other places. The power required to operate these conveyors is said to be extremely small; a 1/3 H.P. motor operating 42 feet in a horizontal run.

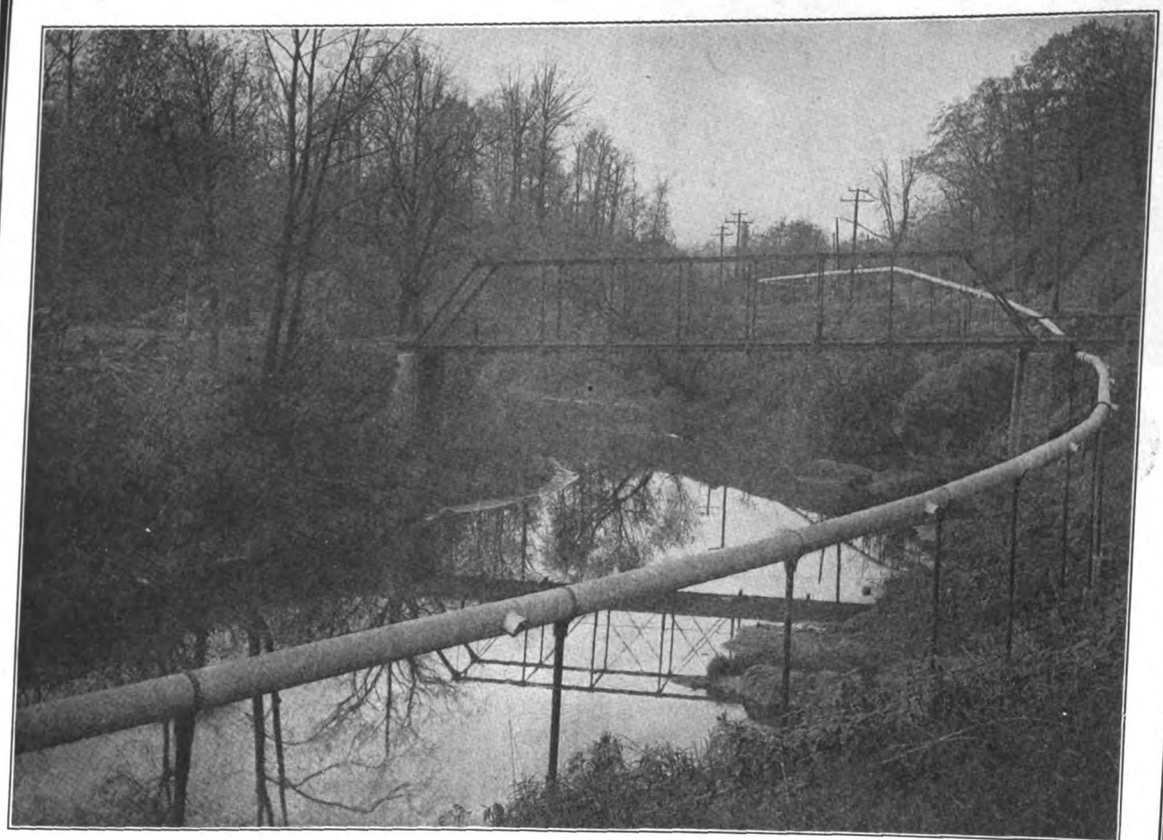
If we consider all the types of equipment that are here shown and then realize that these are only a few of the many that are now being manufactured, we can begin to realize what Materials Handling means and the possibilities of duplicate effort on the part of a good many manufacturers. Because of the widespread interest in the subject it seems pertinent to ask the question, "Is There a Materials Handling Industry?" The answer at this time is "No."

Nevertheless, considering all the present manufacturers who are devoting all their energy and plant facilities to the production of this equipment there are the best indications that at some future date such an industry will evolve. It will be agreed that no type of materials handling equipment is sufficient to perform all the operations necessary, and by no stretch of the imagination would it be possible to produce all types and classes of this equipment within one plant. It will, therefore, be seen that before we can have an industry it will be necessary to bring about a coördination of manufacturers.

Why is it necessary to depart from the present method of handling the business of manufacturing and selling materials handling equipment? This question is also a large one and is placed here more to set executives thinking than for the sake of argument. Let us consider the problem of the average industrial plant executive who has read considerable about the inefficiency of methods of handling materials and who might be already aware that all this applies to his own plant. At the present time he might firmly resolve to remedy these conditions, in so far as they pertain to his plant, but he will be unable to act until he has made a thorough study of the present equipment with the view of selecting that equipment which is best adapted to his peculiar requirements. If he calls on any of the manufacturers, he finds them limited in their scope and endeavoring to equip his plant with only the types of equipment that they can furnish and frequently he finds himself in the position of an engineer trying to make up a comprehensive plan using one or more types of equipment. Because of his lack of knowledge, and the inability of the manufacturers to help him he gives up in disgust or only installs a part of the equipment that is really needed.

It has been pointed out that the Automotive Industry has a well organized system of distribution, sales agencies, and service stations and the writer feels that a better and more complete system of the above points will have to be developed for the materials handling manufacturers. It will only be a few years before the plant executives will demand a more intelligent study of their problem before they will invest thousands of dollars, and this demand from the consumer will do much to develop, what is now a group of individuals, into a real stable industry.

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THIS PNEUMATIC CONVEYING SYSTEM SAVES $7,841.60 EVERY YEAR

Four years ago the Mt. Vernon-Woodberry Mills, Inc., of Baltimore, installed Sturtevant pneumatic conveyors.

These systems carry cotton at a total cost of only $.325 per bale, compared with $.644 when teams were used.

The net annual saving in hauling is $6,507.60. Centralization of the opening and grading work has saved $1,334, or a year in labor and floor space, which makes the total saving $7,841.60 a year. The new method also insures uniformity in grading and mixing, which results in an absolutely uniform product.

Here is a source of increased dividends well worth serious thought. Sturtevant catalog B291 tells how pneumatic conveying systems may be used in many industries.

B. F. STURTEVANT COMPANY

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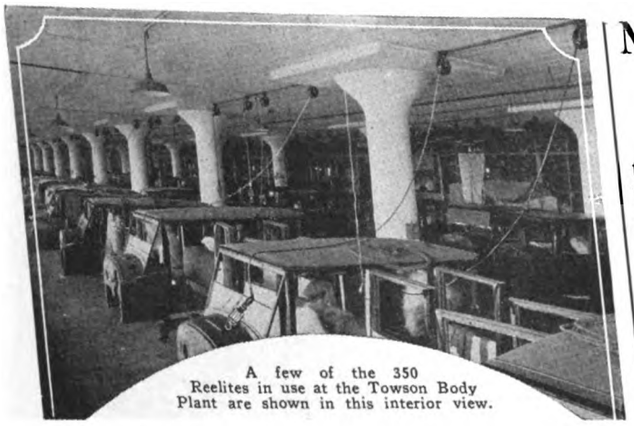
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PUTS AIR TO WORK

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A few of the 350 Reelites in use at the Towson Body Plant are shown in this interior view.



Reelites are made in several sizes holding from 12 to 125 ft. of cord.

Reelites Save Many Dollars for Towson Body Company

"Prior to the installation of the 350 Reelites now in use in our plant," writes the Towson Body Company, "it was necessary for us to constantly replace cords that had been cut to pieces by trucks.

"The Reelites keep the cords out of the way, and show a tremendous saving in time and cord maintenance expenditures over the old style drop cord."

Reelites keep the cords neatly coiled in their steel containers when not in use—clean and unkinked—facilitating the movements of the car bodies and trucks—freeing the aisles of the snares that cause accidents and retard production. The lights are instantly available—within arm's reach—no time lost untangling cords or making extensions.

Our engineers are always ready to help you solve your lighting and power distribution problems. Let them show you the real profit possibilities in *Reelite* protection for the extension cords of your portable lamps and motor-driven tools and machines.

Write for Reelite Folder 314-S.

Appleton Electric Company
1716 Wellington Ave.
Chicago

Reelite
REG. U.S. PAT. OFF.

Maintaining the Electric Lighting System

(*Continued from page* 31)

the plant with correct lighting will have a lower labor turnover. It is very important to avoid direct glare when the intensity of a lighting system is increased. Putting lamps of double the wattage into the same reflectors will double the intensity, but the filament may be visible, causing a glaring effect. Glare causes eye strain with all its attendant evils, and the intelligent manager will give the proper consideration to the eyes of his men, especially as it is to his interest as well as theirs that their eyes be kept in good condition. Under the influence of glare, the pupil of the eye contracts, impairing the sight, but with proper lighting the pupil expands to normal size, allowing correct vision.

The maintenance of the lighting system includes the cleaning of lamps and reflectors and as this work has a very important influence on the lighting efficiency, it should not be neglected. Organized cleaning at regular intervals is the best method of handling this work. The cost of cleaning large steel direct lighting reflectors and lamps averages about five cents per unit. The frequency of cleanings should vary with the class of work done in each department. In even the cleanest of assembling rooms the lighting equipment accumulates a great deal of dust, and at the other extreme, in such places as foundries the dust and dirt will quickly cause a large loss in light and a waste of energy. For each installation it is easy to figure the most economic period for cleaning, considering cost of power, cost of cleaning, loss of light due to dirt and number of hours per day that lamps are burned. In large plants it is usual to have the sanitation department take care of all cleaning, and this subject will be treated in the article dealing with the work of this department.

There are three methods of lighting commonly used in plants: first, the localized lighting; second, general illumination; and third, localized general illumination or group lighting. Local lighting was the first lighting used in plants and it still has its advantages where extremely fine work or deep boring is done. It should always be supplemented with general illumination, as it is very dangerous to have a dark shop with only the few bright spots at the local lights. The men are apt to get hurt by getting caught in belts or gears and are also apt to trip over obstructions on the floor. General illumination using the larger, more efficient lamps is gradually superseding local lighting. With a well designed system there will be no glare, and there will be an even distribution of light. Switches should be conveniently located, and in some cases it will be well to have the wiring laid out so that the middle of a wide room may be lighted before the sections nearer the windows. With low ceilings localized general illumination or group lighting is best, as with this method it is possible to have the light come from the proper direction. As a general rule the power required for a group lighting system is about the same as for a general lighting system. Group lighting gives all the advantages of general lighting and eliminates the disadvantages of local lighting.

When local lights are used on machine tools, elbow

(*Continued on page* 100)

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How Do You Determine Your Shipping Box Costs?

Many manufacturers still think of box costs in terms of invoice prices. Yet they buy factory and office equipment on the basis of definite, expected results.

Isn't it equally important—equally logical—to consider your box purchases in this manner?

The H. O. Cereal Company, manufacturers of Presto Self-Rising Flour, have made a careful study of box costs. And they now use Pioneer (Wirebound) Boxes.

From the first move in assembling Pioneer Boxes to the time they are opened and unpacked, many worthwhile savings are made.

Pioneers are delivered three-fourths assembled. In one day one man can set up as many Pioneers as two men can set up nailed boxes. Labor cost—one-half. Pioneers are closed—and automatically sealed against theft—by simply twisting the wires. Time required—one minute or less.

Pioneers are 30% to 60% lighter than nailed wood boxes—and much stronger. They prevent lumber waste. They lower transportation costs. They safely deliver their contents.

Pioneers are opened simply by cutting the wires. The entire top lifts up. Contents are unpacked quickly and easily.

A General Box Engineer will be glad to study your shipping container requirements and, if possible, design a Pioneer (Wirebound) Box or Crate to suit your needs—at no cost to you. A two cent stamp may save you several thousand dollars.

Write for "General Box Service"—a booklet of information on better boxing and crating methods.

GENERAL BOX COMPANY

508 North Dearborn Street, Chicago, Illinois

SEVENTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

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Louisville, Ky.
Nashville, Tenn.
New Orleans, La.
Pearl River, La.
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Winchendon, Mass.

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(Continued from page 98)

brackets attached to the machine allow the operator to place the light where it is needed. When drop lamps are used they usually are not in the correct position, because it is hard to get the outlet at exactly the right place. However, this may be helped by placing the outlets approximately in the correct position, and then using an approved cord from the outlet, with a cleat which may be fastened to the ceiling anywhere within a radius of a foot from the outlet. By using this method a drop lamp may be located exactly where needed or it can be moved without disturbing the wiring. Benches along the walls may be well lighted by a row of lamps about six inches in from the front of the bench, and on eight to ten foot centers. The size of the lamps depends on the fineness of the work to be done and varies from forty to one hundred watt lamps. Benches in the middle of the room are well lighted by the general illumination.

In order to have a basis for measuring the value of illumination the foot-candle is used as a unit. A small tallow candle flame has a horizontal candle power of one; therefore, if it is held one foot from a wall it will produce an illumination of one foot-candle on it. This unit is a very easy unit to figure with, and, with the aid of a foot-candle meter, it is possible for anyone to measure the intensity of illumination in any part of the plant. The foot-candle meter is very simply operated, and quickly measures illumination right at the point where the work is being done. For rough machining an illumination of three to six foot-candles is desirable, for medium machining from five to ten foot-candles, and for fine machining from eight to sixteen foot-candles. Complete tables giving desirable intensities of illumination for different classes of work are available from the manufacturers of lighting equipment, and it is a very good idea to check the illumination in the various departments occasionally, to find out if the units are being kept clean and old burned out lamps renewed. A record of foot-candle meter readings taken about twice a month will show the condition of the lighting system at all times, and will quickly show any let-up in maintenance of lamps or cleaning. These records show the results secured from the amount spent for lighting and therefore give the cost per unit of light on the job, and this is the true measure of lighting efficiency. Reflectors that are well designed take into account the size of the lamp and the length from the light center to the socket. Therefore in order to get the best results it is necessary to use the right size lamp in all reflectors.

In order to obtain the maximum advantage from good lighting, the surroundings such as ceilings and walls must be kept clean and well painted. As a rule paint is much cheaper than electricity, so for dirty or dusty plants painting is very important. For plants, white paint is to be preferred because it has a much higher coefficient of reflection than any color. White walls and ceilings tend to diffuse any light falling on them and prevent dense shadows which are not desirable.

Most lighting circuits are 110-volt, but there are many 220-volt systems in use. In planning a wiring layout to save copper a 220-volt system seems to be best, but when all points are considered it is admitted by all that 110-volt systems are best. The filament in a 220-volt lamp is nearly twice as long as the same size for 110 volts. This is a serious drawback. The cost of 220-

(Continued on page 102)



The Advice of Specialists —Yours for the Asking

IN the friendly desire to co-operate with inventors and builders of small motor driven tools, novelties or appliances, we maintain our Engineering Department—a corp of specialists whose chief duty is to devise ways and means of applying fractional horsepower motors to new uses.

If you are developing a new product and are perplexed with the problem of finding a motor exactly suited to your needs, we want you to tell our Engineering Department of your difficulties. Years of close contact with the uses and application of small motors—extensive experience in counseling with other inventors and manufacturers, has given the personnel of this department a specialized knowledge that will be extremely helpful to you in the solving of your problem.

Feel free to ask these experts for advice. They'll be glad to do everything possible to help you find a speedy solution to your power unit difficulties and will give frank and impartial opinions on any motor question. Fill in and mail the DUMORE Survey Blank, attaching rough sketch or blue print of your product.

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Dumore
Fractional H.P. Motors

DUMORE Survey Blank
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(a) Motor will be used for (State purpose).....
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(d) For constant.....or intermittent.....service.
(e) Motor will.....or will not.....be enclosed in machine.
(f) We will require.....R. P. M. (State speed).
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For Concrete or Masonry

Stonetex is more than an ordinary paint. It is made especially for concrete, stucco and brick. Stonetex damp-proofs the wall—resists the free alkali in cement and mortar—penetrates the surface, becoming integral with the wall—enhances the beauty of the original texture. Stonetex makes old buildings look like new.

The principal cost of painting is in the labor of applying it. Ordinary paints used on concrete and masonry are expensive. Stonetex is economical paint because of its long life and serviceability. It is moderate in price.

Leading industries, such as Standard Oil, Palmolive, Eastman Kodak, Ford Motor, Mishawaka Woolen Mills, Western Electric, etc., use Stonetex to protect exterior masonry.

Help for Maintenance Engineers

Let us solve your maintenance problems. Make Truscon Maintenance Engineering an auxiliary to your own Maintenance Department. We have the laboratory facilities, the technically trained experts and a wealth of experience covering every type of building maintenance from exterior maintenance coatings such as Stonetex to waterproofing basements; from supplying special transparent varnishes to fume-resistant coatings; from daylighting building interiors to hardening concrete floors.

This experience is used by building owners all over the country. State your problem, and the Truscon Maintenance Engineers will make detailed report without obligating you in any way. Return coupon or write letter.

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TRUSCON MAINTENANCE ENGINEERING





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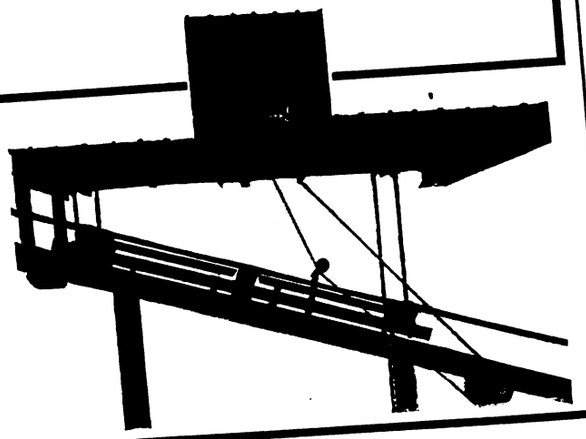
How much Coal did you receive last week?

Of course, the bills of lading will tell you —but are they correct? How do you know for certain unless you weigh the cars as they come?

And how about your sand, gravel, coke, ore and other conveyor handled material? Are you receiving and giving the proper amounts? Why not be sure about these important things?

The quickest, most economical and at the same time most accurate method of weight calculation for materials of this nature is the Merrick Weightometer. It operates as the materials are moving on the conveyor without interrupting or retarding the flow. And its results are guaranteed to be 99 per cent accurate.

Hundreds of concerns now rely on the Merrick Weightometer. Send for "Merrick Circulars" and see the different types of installations for yourself.



Merrick Scale Mfg. Co.

180 Autumn Street
Passaic, N. J.

(*Continued from page* 100)

volt lamps is more than 110-volt lamps on account of more labor and material in the 220-volt lamps due to longer filament and also to the fact that 110-volt lamps are much more standardized and make up nine-tenths of the business of the lamp manufacturers. If alternating current is being purchased and is stepped down to 220 volts it is easy to change over to 110 volt lighting as most transformers have mid-taps which will give 110 volts. If the current is generated in the plant at 220 volts it is necessary to put in a balancer coil and use 3-wire distribution. With an installation operating at 220 volts direct current, a motor generator set or balancer should be used for changing to a 110 volt system. The savings, in any of the systems mentioned, should soon return the money invested to make the change.

The life of lamps is a very important point because the cost of illumination is the cost of the electrical energy used, plus the cost of renewals of lamps. A lamp may be designed to have a very long life but in order to do this it must operate at a low temperature and naturally is not as efficient as one operating at higher temperature. A long lived lamp will reduce the number of lamp renewals but it will increase the cost of light because it will consume more electrical energy. The most economical life of a lamp is the point where the sum of the costs of electrical energy and lamp renewals are the smallest. There is a great deal of variation in the life of lamps so any tests should be made on a large number of lamps rather than on only a few. It is very important that lamps of the correct voltage be used. If the voltage of the circuit is higher than the lamp label voltage, the lamps will soon burn out. If the voltage of the circuit is lower than the lamp label voltage, the lamps will not give their proper amount of light. When the voltage fluctuates it is best to order lamps of a voltage near the average of the fluctuation.

When electric lamps are burned the filament gradually becomes smaller due to evaporation of small particles which are deposited on the inside of the bulb, blackening it and absorbing the light. An average life of one thousand hours is usual before having to remove lamps due to blackening, but many will have to be removed before this. Dust, oil and moisture collecting on the outside of the lamp cut down the light more than most people realize and this accumulation should always be cleaned off when the reflectors are cleaned.

For local lighting such as drop lamps and bracket lamps the mill type lamps are suggested. They have a short stem and flexible supports and therefore have more strength than regular lamps. They are specially made for conditions where lamps are subject to vibration or shocks. With the large lamps used in general lighting it is necessary to protect the eyes of the men from the bright filament when open reflectors are used. The bowl enameled lamp has superseded the bowl frosted lamp for this purpose. The enameling is a smooth coating of white translucent material which can be easily cleaned. It gives much better diffusion than frosting, and does not discolor with heat through use. Many plants have adopted locked sockets or locked guards on lamps in order to eliminate pilferage of lamps. This practice undoubtedly saves lamps but it has the disadvantage of having to send a man from the electricians' department every time a lamp burns out. This may be

(*Continued on page* 104)

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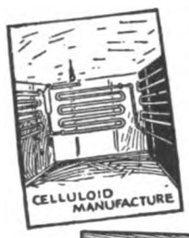








AUTOMATIC REFRIGERATION





A FACT—There is but ONE AUTOMATIC

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Syrup Storage
Ice Making
Molded Parts Manufacture
Powder Manufacture
Time Fuse Manufacture
Low Temperature Tests for Automobile and Oil Manufacture.
Watch Manufacture
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Artificial Silk Manufacture
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Profitable refrigeration applications revealed by the cold light of research—

Facts count. Especially when backed up by the cold light of research. And the facts we have gathered prove conclusively that in many varied industries—Automatic Refrigeration has been a highly profitable investment.

Leading industrials like Carnegie Steel, Bridgeport Brass, National Cash Register, Worcester Royal Corset, Hartford Electric Light and hundreds of others including chemical plants, mines, and others have found that the savings made possible by Automatic Refrigeration quickly repay the capital invested and then continue to save upwards of $3,000 a year.

Wherever absolute uniformity of product is imperative—such as in preparation of edible oils, candy making, steel quenching, solvent recovery, storage battery manufacture—in fact anywhere that a constant humidity or temperature is the controlling factor—Automatic Refrigeration is a vital necessity.

Give a thought to conditions in your own plant. How can Automatic Refrigeration help you? Check over the list given above. If there is a question as to additional uses please drop us a line. Our files, no doubt, will reveal just what you are looking for. Fill out the coupon and send it to us.



The Automatic Refrigerating Co.,
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Please send details on Automatic System of Refrigeration.

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estigate the AUTOMATIC of Hartford To-Day—Mail this Coupon

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(*Continued from page* 102)

taken care of by a junior electrician, who answers the telephone calls for lamps. Lamps should be purchased in standard packages whenever possible as the prices are usually much lower in this case. Also if possible all lamp purchases should be made on a contract by the year in order to get the advantage of large quantities.

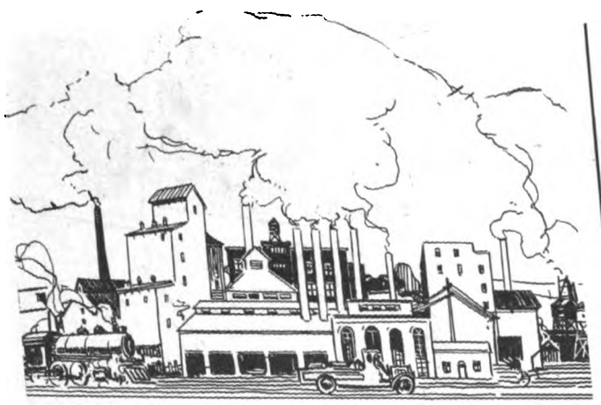
In most plants direct lighting steel reflectors are used for general lighting as these are the most economical units to install and maintain. When more diffusion is needed a similar reflector with a glass diffusing globe is often used. These two types make up most of the installations in the plant proper, but for special rooms or offices the semi-indirect or totally indirect fixtures are desirable. The so-called RLM Standard Dome reflector is being generally adopted for the great majority of plant requirements. RLM Standard is abbreviated from Reflector and Lamp Manufacturers' Standard. These reflectors were designed by engineers from the leading manufacturers and are built to specifications. The quality of the enamel is very important, the surface should be smooth as glass so that it may be easily cleaned and the luster not impaired by scrubbing.

The reflectors on the large general lighting units are easier to clean if they are easily removable so that they may be cleaned on the floor. With a spare reflector and lamp, one trip up the ladder will suffice. When reflectors become chipped they may be painted on the outside and the chipped spots touched up on the inside. These may be used as spares to replace others that become damaged. On overhead general lights it is not generally necessary to put on a wire guard to protect the lamp from breakage, but on drop lights the breakage is apt to be very high, and guards are advisable. They perform the double duty of protecting the lamps from breakage and pilferage.

Sockets on overhead general lights may be keyless, as they are controlled by snap switches on walls or columns, or else pull chain sockets are used so that each individual light may be turned on or off. Pendant switches are also used for controlling overhead lights. However, it is best not to allow individuals to control the general lighting because it is usually necessary to light up at least a section of the room if any light is needed. Key sockets should be used on individual drop lights and bracket lights, and operators should be instructed to turn off the light when they finish work at a machine. Locked sockets are a good investment on all drop lights. In order to get at lamps and reflectors in high ceilinged rooms to clean them and replace lamps the automatic cut-out hangers have been developed. These allow the socket, reflector and lamp to be lowered to the floor, for cleaning, by the use of a lowering rope. No ladders are required and the saving in time and the protection against short circuits as well as the safety of working on the floor instead of on a high ladder are all points in favor of these cut-out hangers. If maintenance of units like this is made easy and safe, it is probable that they will be taken care of more often.

The main switchboxes for lighting are usually near the center of the building, on a blank wall if there happens to be one near that location. The safest way is to have a safety panel in which the live portions are locked up and only the switchbuttons themselves are exposed. These are much more expensive than the regular switch-

(*Continued on page* 108)



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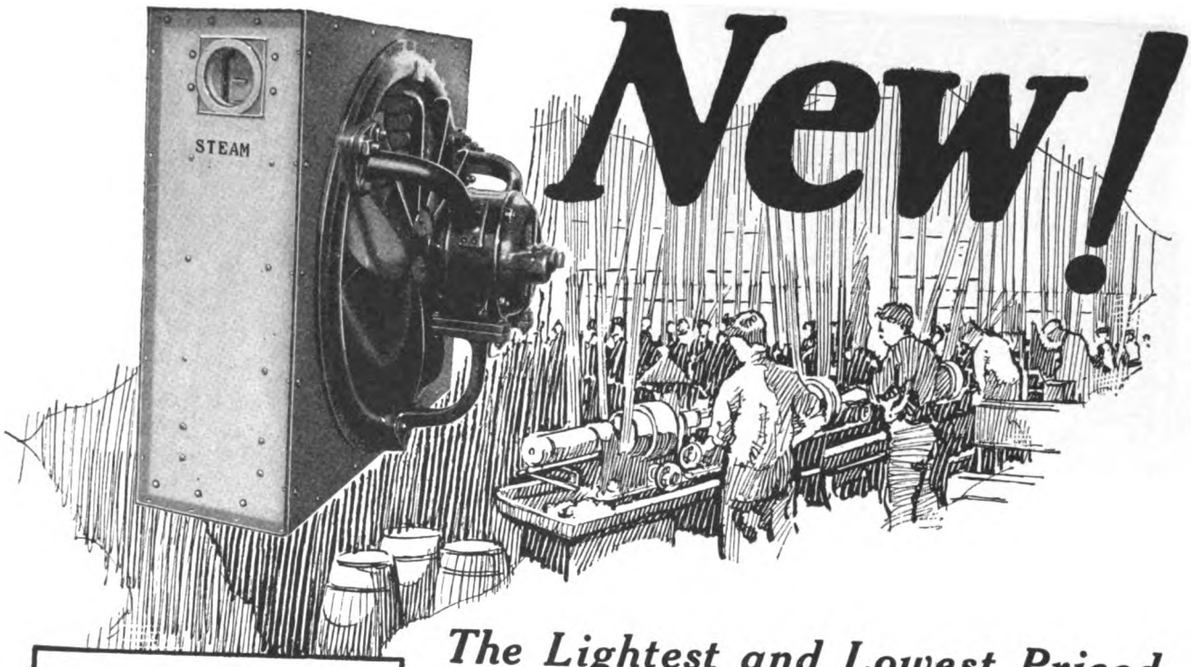
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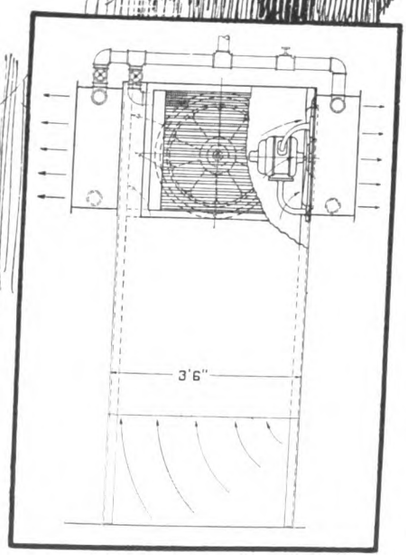
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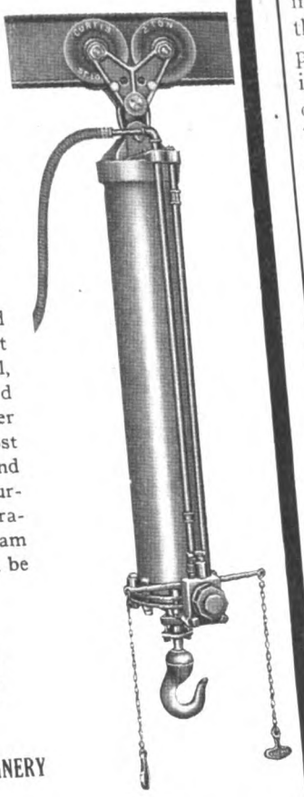
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(*Continued from page* 104)

boxes using knife switches in a steel box. Each switch should be numbered and a key or chart should be fastened inside the cover so that anyone can see what section of the room each switch controls. If only a few large groups are controlled from the switchbox it is well to have push button control on the columns.

The maintenance cost of fuses on properly designed lighting circuits should not be large, because the circuits should have ample capacity and should be correctly fused. On this service the one-time fuse will usually be lower in cost. Renewable fuses are often standardized all through the plant and in this case they should also be used on the lighting circuits. All fuses should bear the underwriters' approval.

In many plants there are places where the lighting wires are not in conduit and this should be done whenever possible, especially when necessary changes are being made. The quality of the covering on wire has an important bearing on the length of time it will last as it has a tendency to dry up and get brittle and crack. The protective braid helps to keep the insulation intact as the wire is being pulled into the conduit. In order to install more or larger lamps it is necessary to reinforce the wiring either by putting in additional wire or by putting in larger wires. If the conduit is large enough, it is possible to replace the present wires with larger ones or to reinforce them by pulling in additional wire. This is why it is always advisable to put in conduit a trifle larger than necessary to take care of possible future additions.

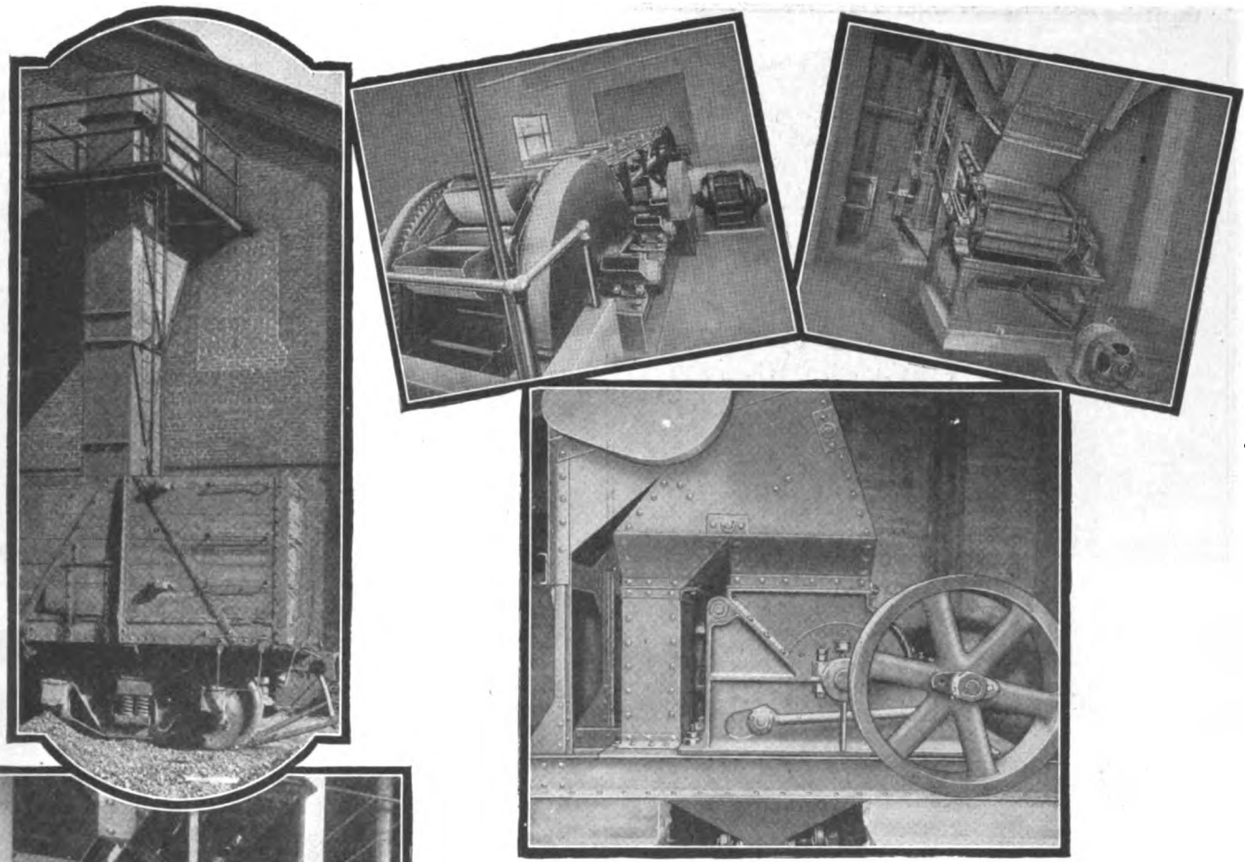
Conduit fittings must be used when square corners are necessary on conduit work such as following around beams. However, when bends are possible they should be used as they save the expense of fittings and also allow pulling in the wire in longer lengths. Junction boxes and pull boxes should be of ample size to make it easy to pull the wire through and allow room for the spliced ends.

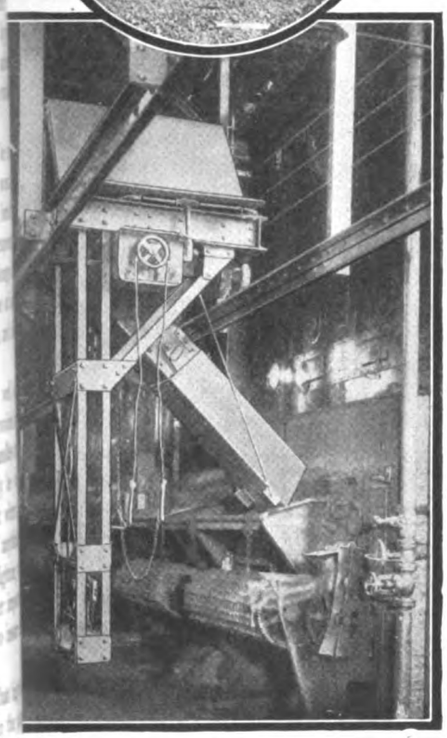
Stairways should be well lighted for safety's sake. The usual intensities provided in the codes are very low and two to five foot-candles are recommended. Stairways should preferably be on an independent circuit carried from the point where the main service enters the building, so that if anything happens to the lighting in one room, the stair lighting will be all right. The sills at elevators are another important place that should be well lighted in order to insure safety to the men using trucks.

It has been proved that high intensity illumination has increased production in the plant and the same increase may be expected in the office. The eye is soon fatigued when a typist is working on a typewriter if it is not properly lighted because the shifting shadows strain the eye. For general clerical work an intensity of ten to fifteen foot-candles is now being used by many progressive firms although most of the standards now in use are from five to ten foot-candles. Semi-indirect lighting is more efficient than totally indirect and is therefore used more often. Direct lighting is the most efficient means of getting the maximum illumination for the same amount of power. However, bowl enameled lamps should always be used in open bottom reflectors to eliminate glare, and if possible reflectors should be used that are translucent in order to avoid a dark ceiling which

(*Continued on page* 110)

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(*Continued from page* 108)

makes the room appear gloomy. Totally enclosed glass units that reflect most of the light downward without glare are very efficient and produce a uniform intensity and a pleasing appearance.

Drafting rooms require a high intensity of well diffused illumination and a very even distribution in order to avoid shadows when working close to a triangle or T-square. The lighting should be arranged so that the direction of the light at tables near the windows is the same as daylight. This usually requires that a row of lights be hung about two feet from the windows. Sometimes a medium general illumination is supplemented by a local lamp for each drawing board. These local lamps are usually of the movable bracket type so that the light may be directed where it is needed. There is more liability of glaring reflections with local lamps as most people are continually shifting their lights around.

The wiring for a calling system for finding executives out in the plant is usually very simple. Various systems of bells and lights are used with the control box at the telephone switchboard. Once properly installed very little maintenance is necessary except an occasional adjustment on a bell.

Some sort of inspection is necessary if the efficiency of the lighting installation is to be kept up. The periodic check up with a foot-candle meter to make sure that the system is all right should also include a check with an ammeter and voltmeter to see that power is not being wasted. In many cases nearly half of the light which is paid for is wasted because no attention is paid to maintenance requirements. If the value of the light wasted was the only point to be considered the matter would not be serious, but to get a correct figure on the value of this light it is necessary to take into account the decrease in production due to the smaller amount of light. When this is figured out the cost of the wasted light will be found to be so high that the waste will not be allowed to go on very long.



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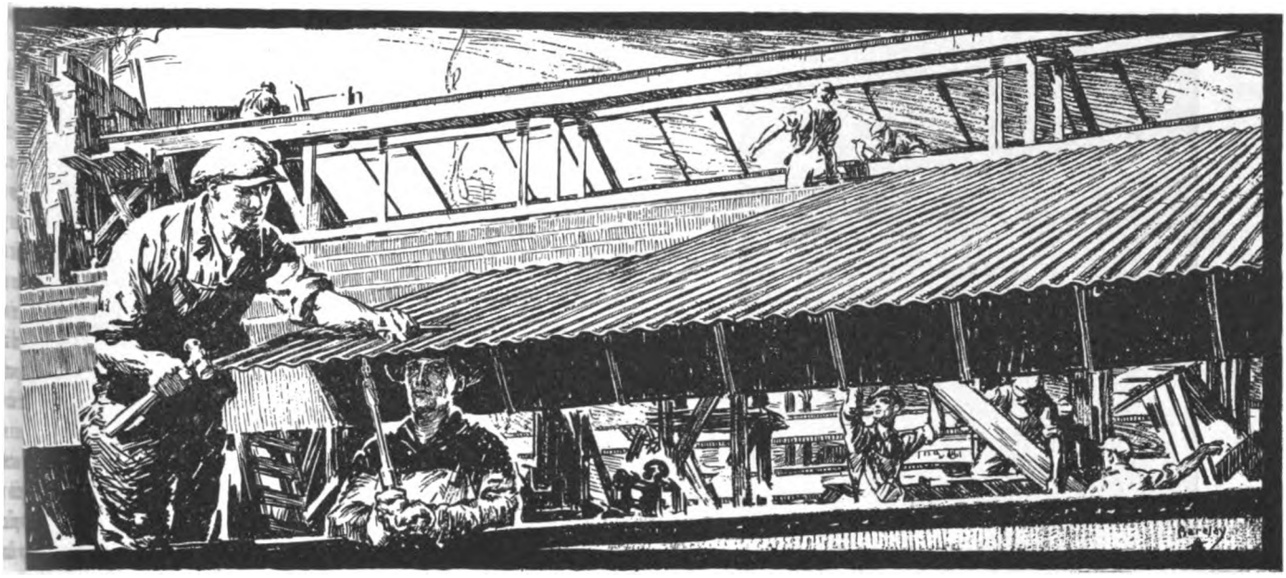
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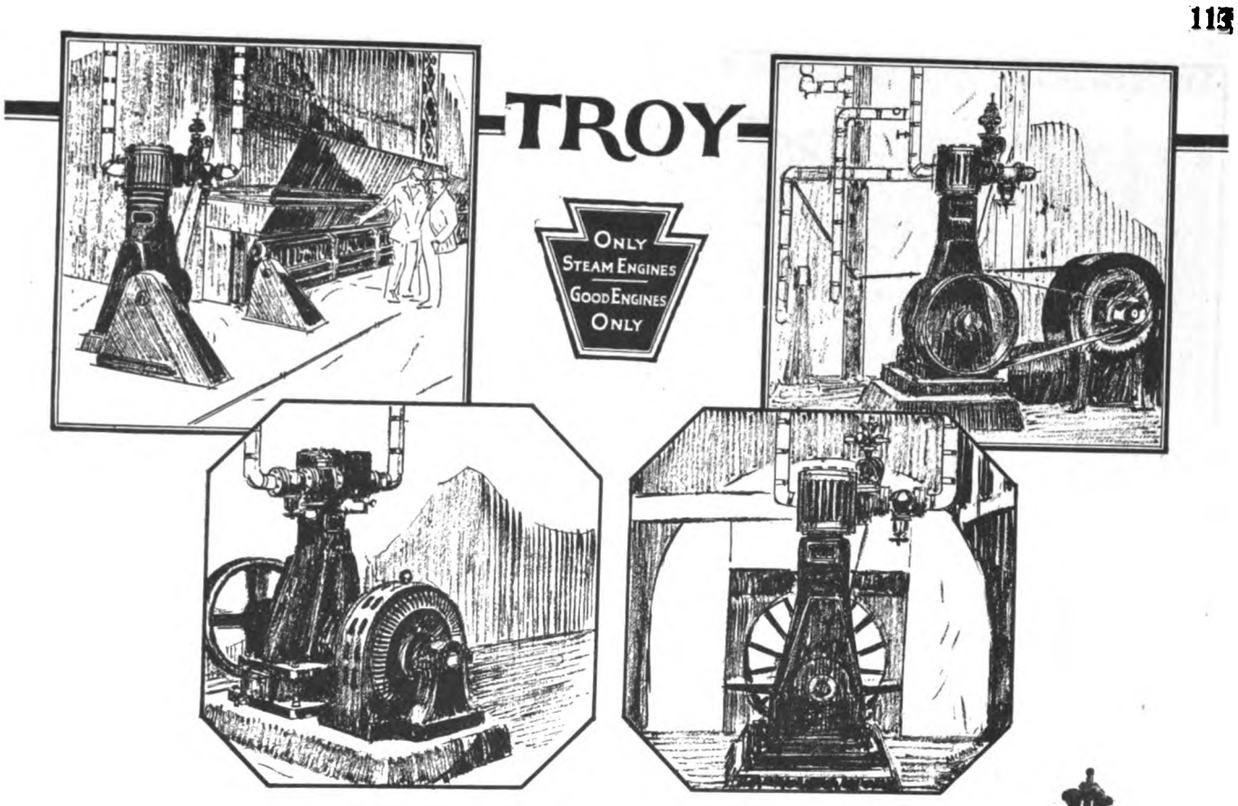
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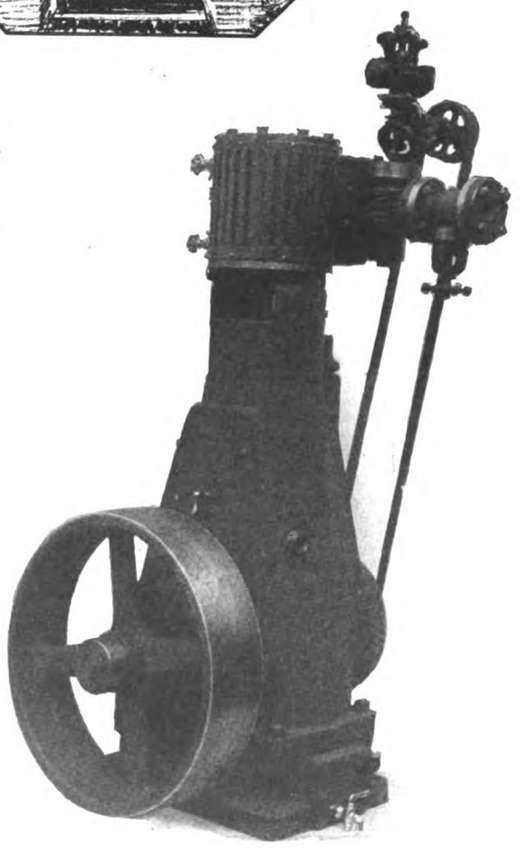
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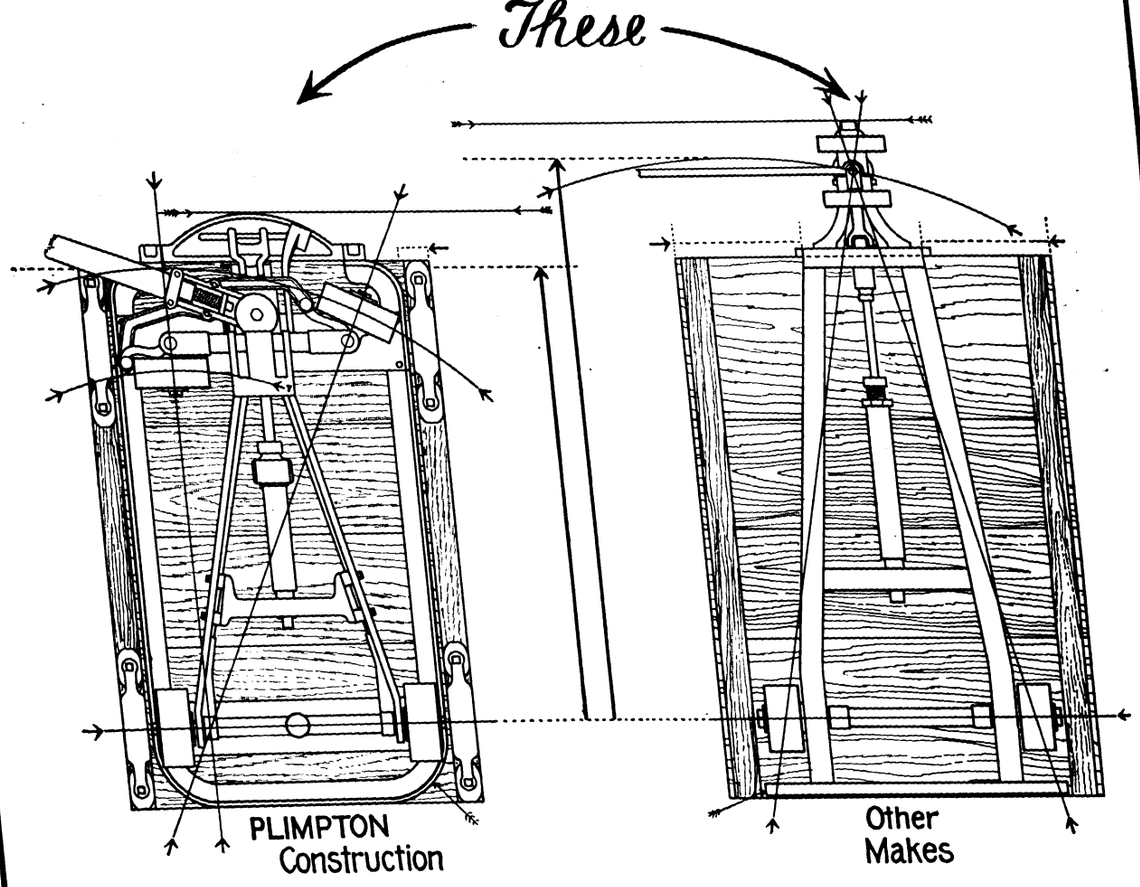
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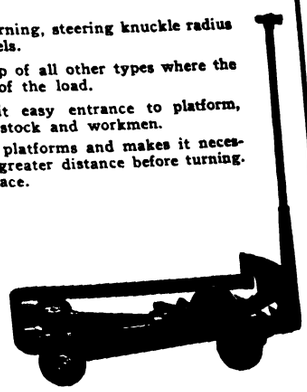


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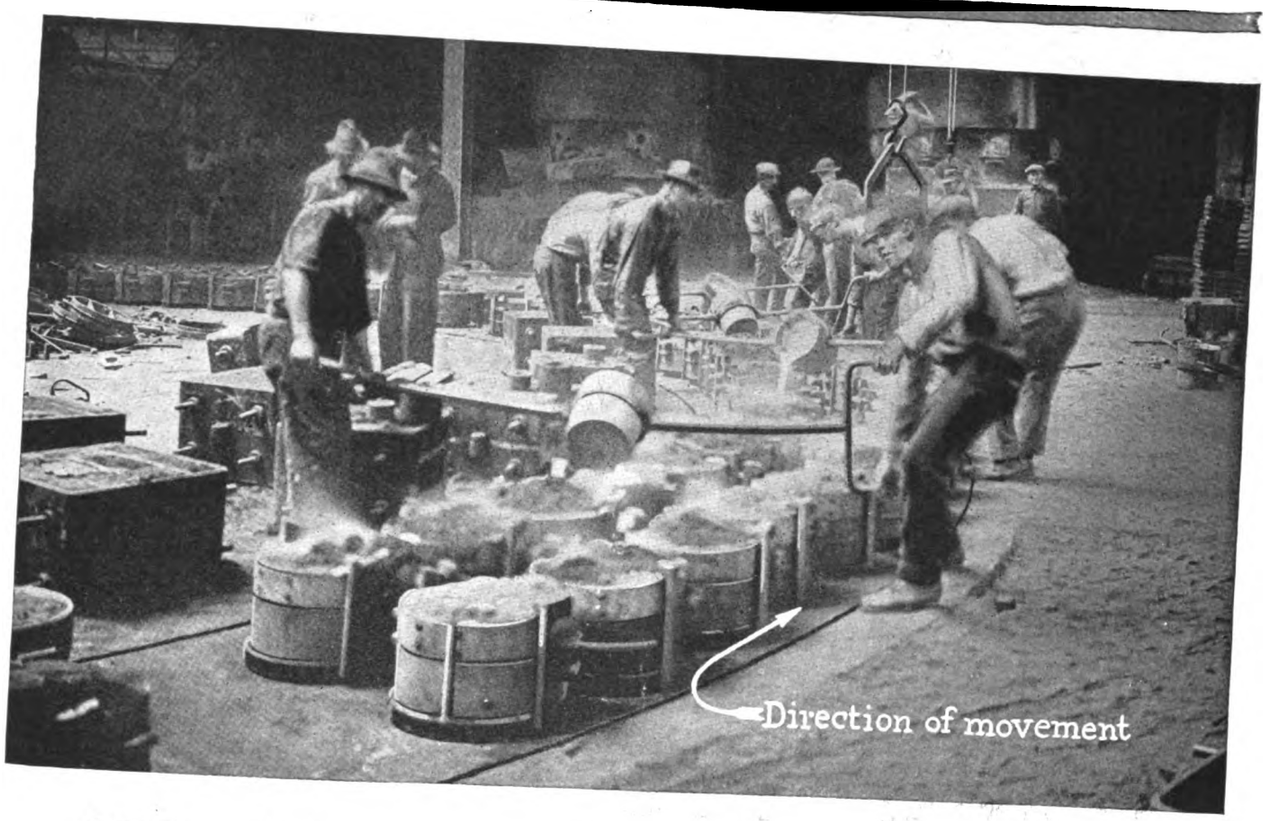
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Engineering Department, Stamford, Conn., U. S. A.

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Would you pay moulders' wages for this pouring off job?

PAYING moulders wages—among the highest in all industry—for lumpers' work, sounds like an absurd way to throw away money! Yet in some foundries the moulders are forced to leave their work in the middle of the afternoon, to pour metal, knock out castings, and move sand.

But mechanical handling has changed all this. The picture shows part of the system in the Lycoming Motor Company foundry, Williamsport, Pa., which separates the moulding from the lower scale jobs. This circular conveyor carries moulds from the moulders, past the cupolas where they are poured.

With this system, moulders make moulds all day long. The pouring gang spend all their time pouring or working around the cupola. Castings are knocked out by other laborers. Most of the actual handling of moulds, castings, sand, etc., is done mechanically, reducing the lugging and hauling to practically nothing.

In addition to saving 25% to 40% of the moulders' time, conveyors ensure that work flows steadily through the foundry, and to the cleaners; instead of being carried in spasmodic batches; material in process is cut down; the time material is in process is correspondingly reduced; and the floor space required is cut in half. In one shop, this system paid for itself in a few months, while savings of from 50% to 100% of the cost of the system each year, are common.

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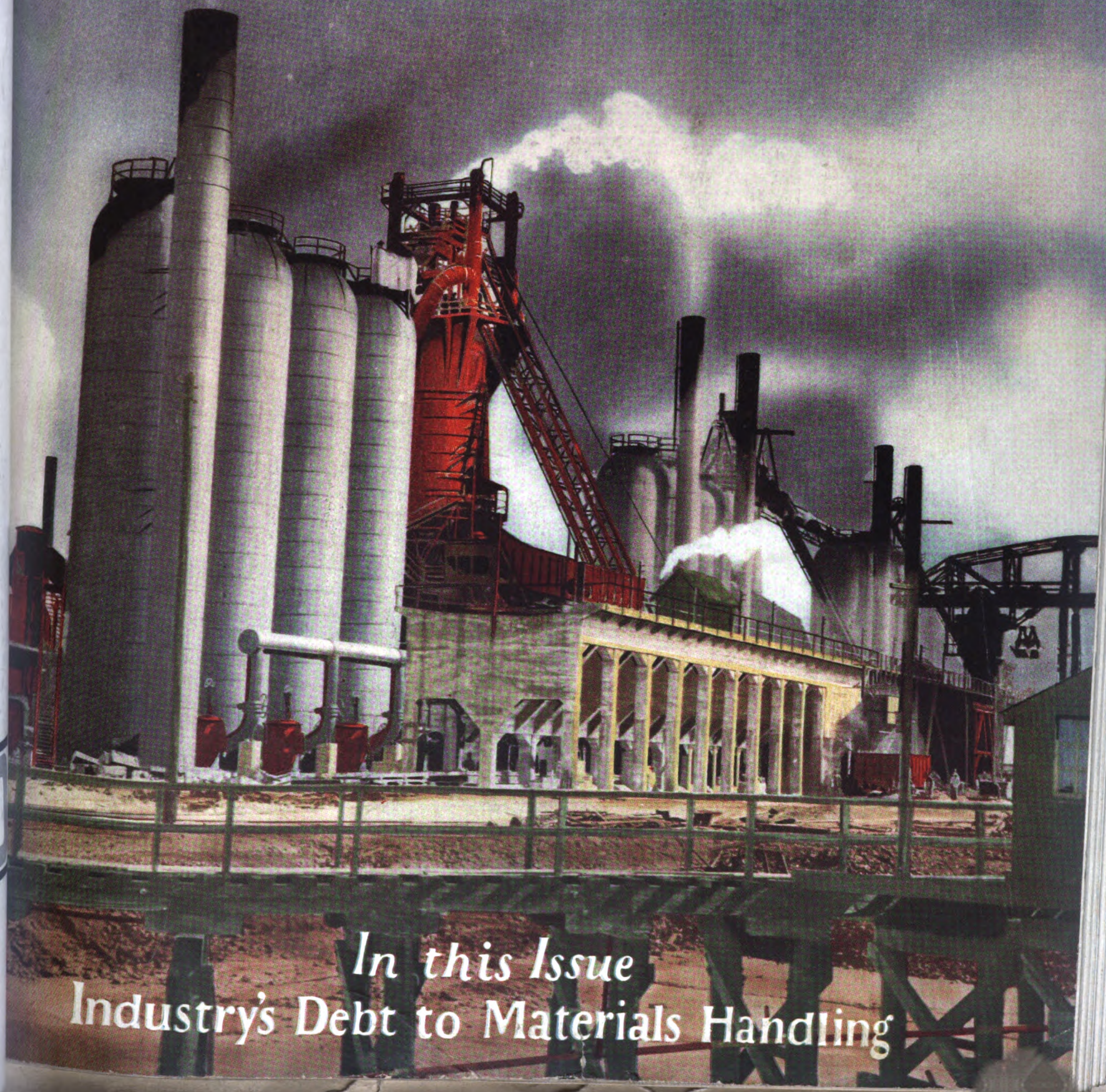
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Industry Illustrated

Men, Methods and Machinery of Modern Management

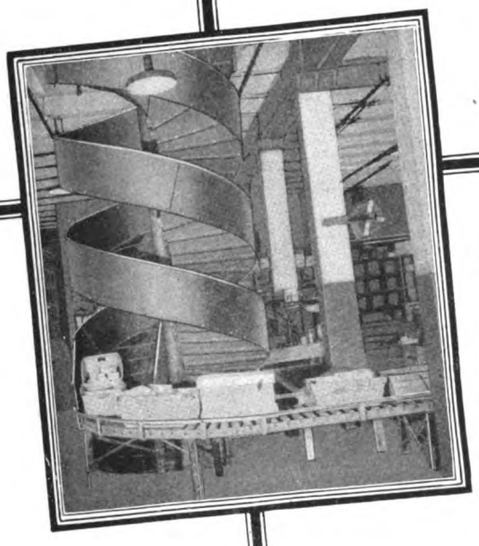
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In this Issue

Industry's Debt to Materials Handling

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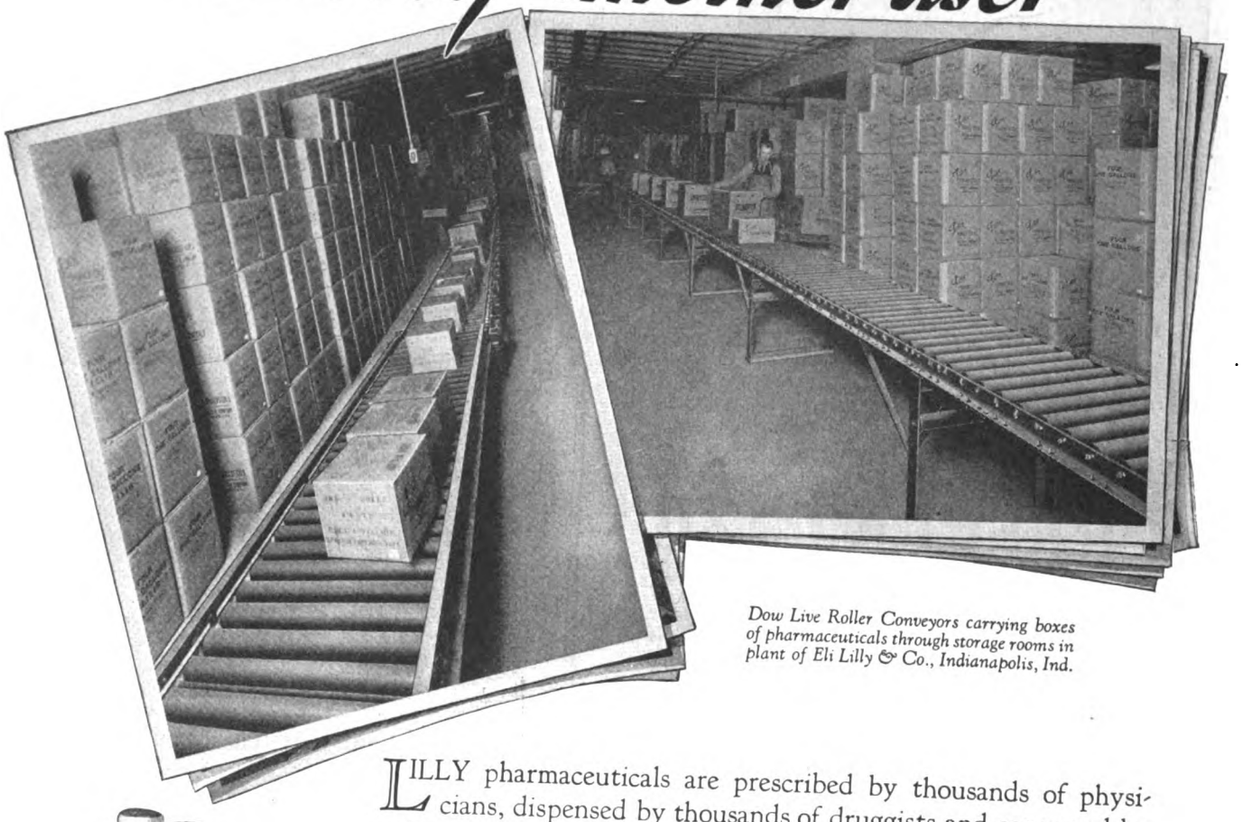
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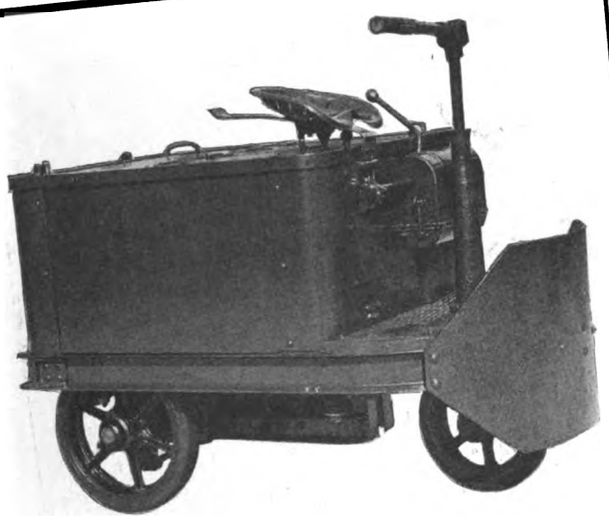
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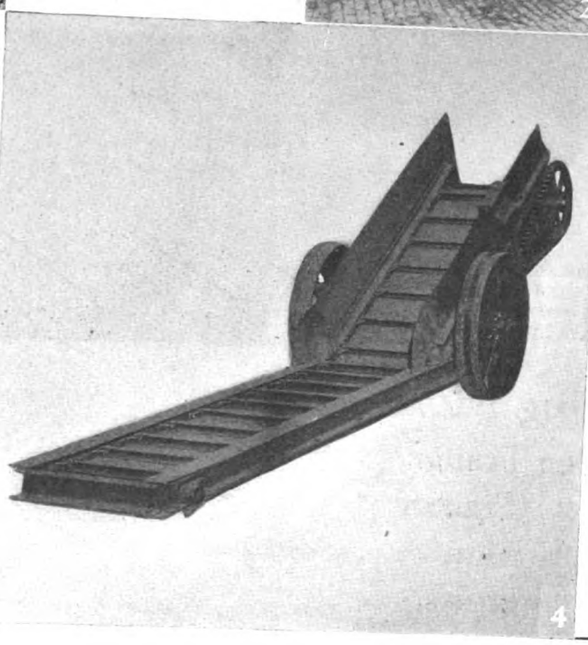
1—*Showing the Barber-Greene Coal Feeder discharging to conveyors. It unloaded a 50-ton car in 55 minutes to inside storage.*



2—*Where two Barber-Greene Conveyors enable two men to handle 4000 tons of coal a month the year 'round.*

3—*Two Barber-Greene Conveyors and one man have replaced six men in handling sand, coal and slag at the Spaulding Coal Co., of Elyria, Ohio. One of these, the U-Type, is shown here. Its base price is $350.*







4—*The Barber-Greene Coal Feeder. Its horizontal extension rests on the rails so that no pit is required. It is enabling many plants to do away with expensive shovel gangs.*

5—*Showing a Barber-Greene Conveyor unloading a barge of cement for a large materials company.*

Storing From Hopper-Bottom Cars Without Shovelers

A certain company in Detroit found that it was costing them $25 to $30 a car to unload their coal by hand—or a yearly total of $3900.

Yet as they used only three cars a week, the tonnage was too small to warrant the expense of elaborate equipment, such as track pits, elevators, etc.

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In this manner an entire car was unloaded in 50 minutes, with only one man operating. A second man was needed only when the car was moved from one pocket to another.

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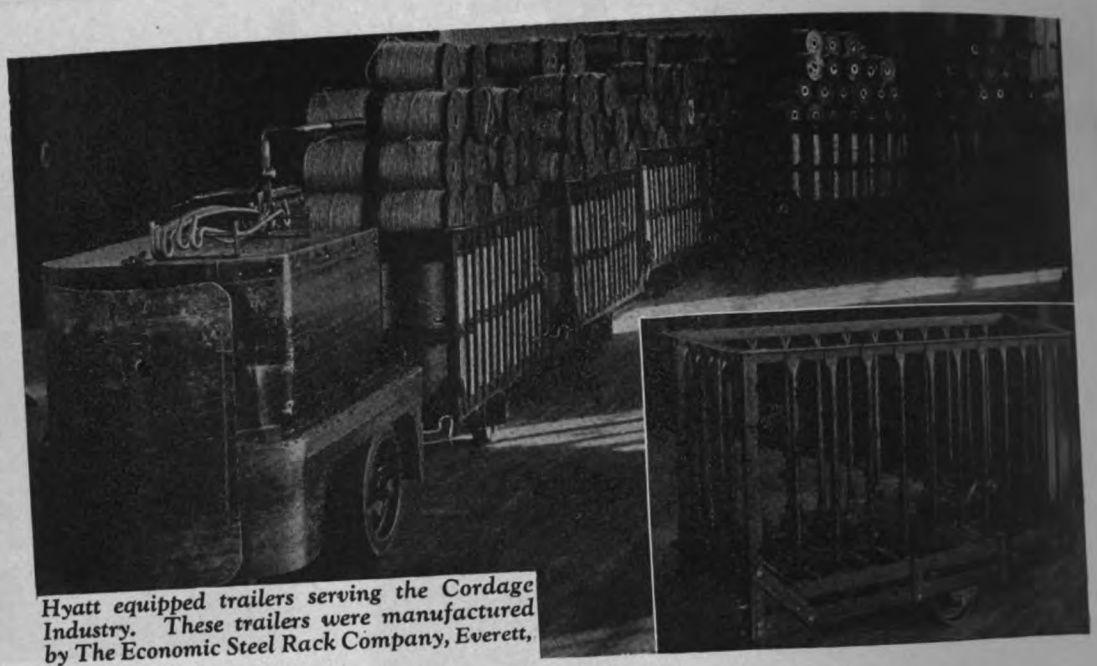
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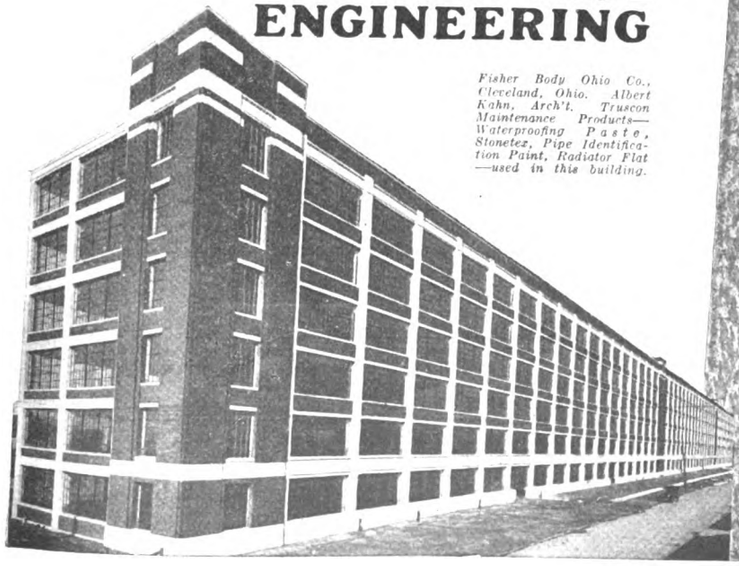
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Our Bulletin 1994 covers these tests in detail. We will be glad to send a copy to those interested in getting better results from their industrial trucks and tractors.



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The paragraph quoted above is the brief introduction to our booklet containing a letter from each of the twenty-four concerns whose average yearly profit on JACKLIFTS is over 600%.

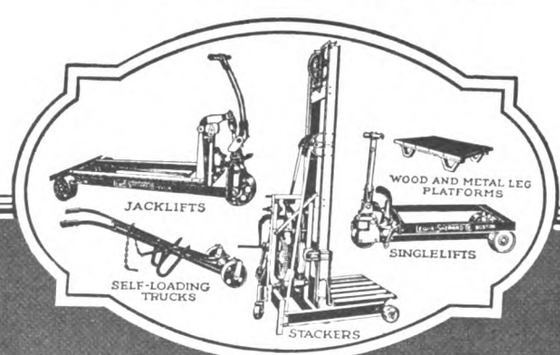
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"Lo-Hed" Hoist (2,000 lb. capacity) made by American Engineering Company, Philadelphia, Pa., in operation at the Hudson Printing Company, Hoboken, N. J.

This hoist requires very little head-room, as the picture indicates. Hyatt roller bearings are used throughout the hoist mechanism and in the trolley wheels, insuring satisfactory operation.

The Result of 20 Years' Experience

As a result of twenty years' experience in planning and constructing hoists, the engineers who designed the "Lo-Hed" monorail hoist, "the electric hoist that operates in the minimum headroom", used Hyatt roller bearings throughout.

The American Engineering Company mentions among the features of its "Lo-Hed" hoists, that are of particular value, the following:

"Lo-Hed" Advantages

1. "Positive automatic lubrication and minimum wear, because all gears and main bearings operate in an oil bath."
2. "Mechanical efficiency of over 80%."
3. "Only the best materials and finest workmanship are used in its construction."
4. "Frictional losses are reduced to a minimum by the use of Hyatt 'High-Duty' bearings throughout."

Note—

Hyatt roller construction makes them self lubricating and self cleansing. Some Hyatt bearings have been operating over 33 years without appreciable wear.

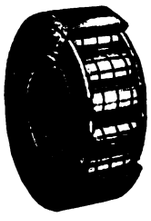
True rolling motion of Hyatt bearings reduces friction 50% to 75%.

Hyatt rollers are made of chrome-alloy steel, hardened and ground. Hyatt races are of high carbon steel in all cases

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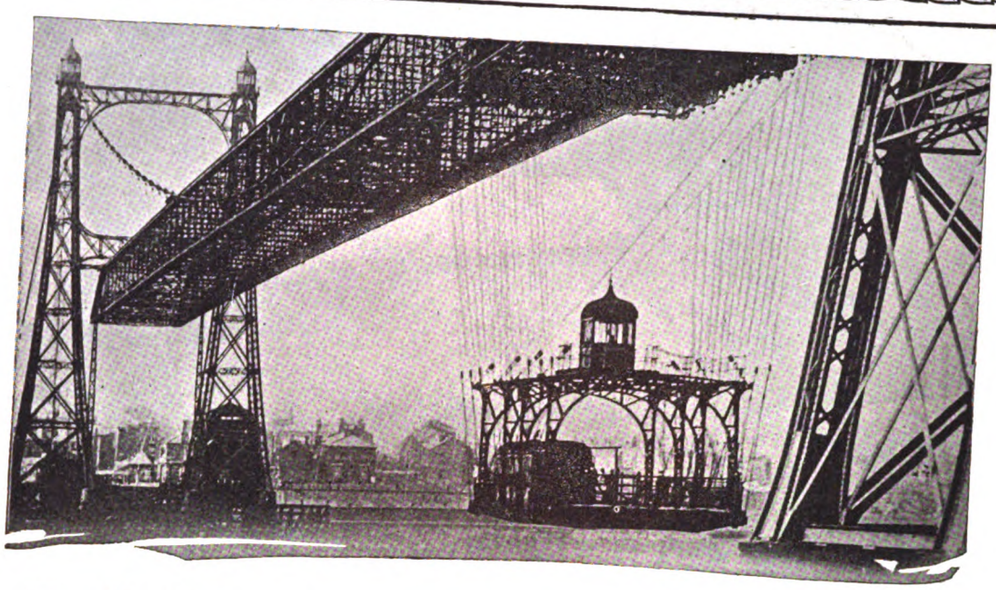


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Ball Bearing Aero-Ferry Makes 1000-Foot Trips Across Mersey River

SWINGING high above the water this aero-ferry of the Widnes Transporter Bridge, connecting the little manufacturing town of Widnes, Lancashire with Cheshire, England, makes 1000-foot trips across the Mersey River carrying passengers and vehicles. The aero-ferry is suspended by steel cables from a truck travelling on the lower part of the bridge. The towers are 200 feet high.

Skayef ball bearings on the wheels of the truck, which is 55 feet long and 24 feet wide, make possible the non-failing service of this novel ferry. The load is carried on polished steel balls which roll practically frictionless in hardened races of steel.

Although this is an unusual application of Skayef ball bearings, they will give the same degree of unfailing performance, reduce friction, save power and cut maintenance costs, when applied to automotive and industrial equipment.

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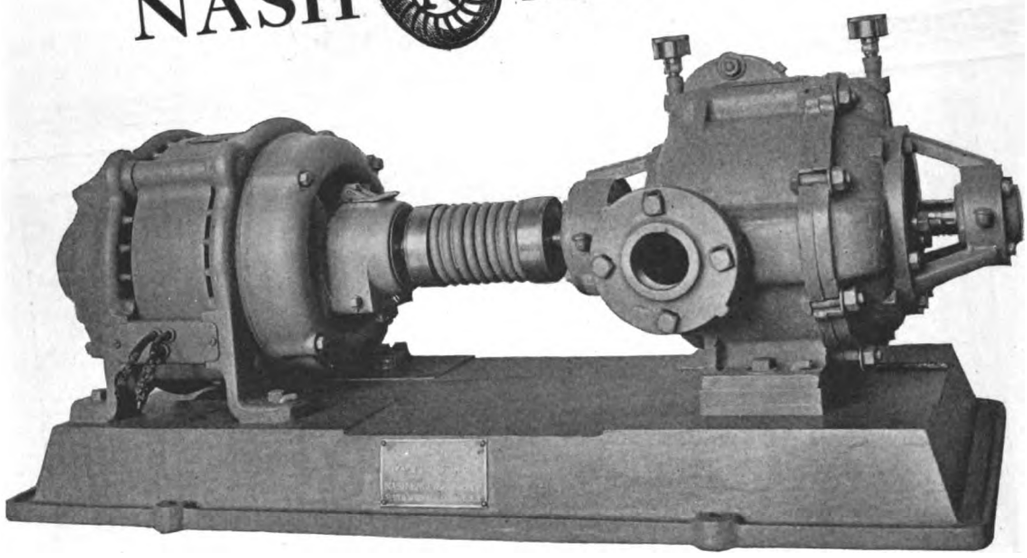


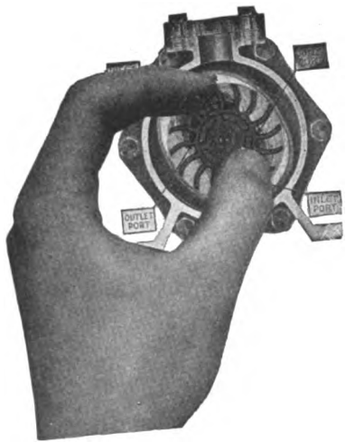
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Industry Illustrated

The Pictorial Presentation of Practical Management

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W. THOMSON LEES, MATTHEW W. POTTS } *Associate Editors*

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Editorial

What Does "Labor-Saving" Mean?

IT was less than a hundred years ago that the school board of Lancaster, Ohio, indignantly refused the use of their school house for a meeting to discuss whether railroads were practical; stating as the basis for their refusal, that "such things as railroads are impossibilities and rank infidelities."

It is little more than a hundred years since Dr. Cartwright's invention of the power-loom precipitated strikes and sabotage on the part of the hand weavers, who felt that this wonderful invention would destroy their means of livelihood.

Only sixty years ago, in England, a law was passed for the regulation of road locomotives—forerunners of the modern automobile—which required a speed of less than four miles an hour, and further required that a man with a red flag should precede the locomotive!

In truth, machinery has had a hard time of it in convincing mankind of its benevolent intentions. At every step of the way it has met with determined and deeply entrenched resistance: the resistance of prejudice, of ignorance, of superstition. And, slowly but surely, the mechanical ideal has conquered; until, today, even the non-technical man in the street begins to realize that in the wider use and fuller development of mechanical genius lies the immediate hope of a more desirable state of human existence.

There is one misconception, however, which remains to a greater or less degree: the conception that every new labor-saving machine put into operation means just so many men deprived of jobs; that a machine which "can do the work of thirty men" will, therefore, deprive those thirty of a means of livelihood.

A hundred years ago, when the factory system was new, the introduction of the power-loom did temporarily deprive men of jobs; but in a few years' time it had created vastly more and better paid jobs than had existed before. Today, with the multiplicity of jobs, skilled, semi-skilled, and unskilled, this same readjustment is a matter not of years but of days.

Picture the Ford plant at River Rouge, stripped of its labor-saving machinery. How many cars could it produce; how many people could afford to buy these cars at the necessarily higher price; how many men would the Ford Company have to employ, and what could it afford to pay them?

Labor-saving machinery *saves labor*. It does not dispense with laborers; it does not do away with men's means of livelihood. Labor-saving machinery provides a means of *saving*—and *storing* up—labor; making the work of men vastly more productive, and gradually lifting mankind from the necessity for back-breaking, soul-destroying drudgery.

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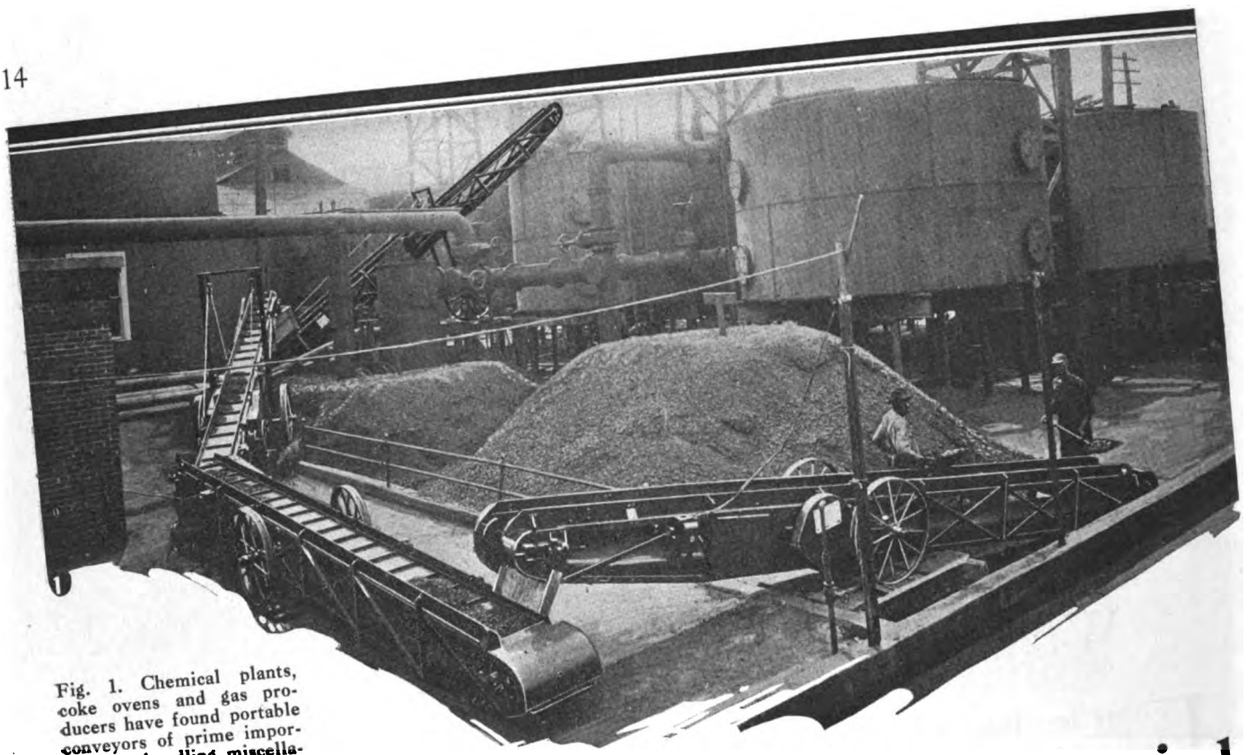


Fig. 1. Chemical plants, coke ovens and gas producers have found portable conveyors of prime importance in handling miscellaneous bulk materials.

Industry's Debt to Materials Handling

The Keystone of Modern Production Methods

By Matthew W. Potts

TEN years ago, industry throughout the United States and Europe gave very little consideration to the conservation and proper application of labor, especially common or unskilled labor. In 1914, when Europe was called upon to take men from industry in order to seemingly settle the affairs of the world it became necessary to replace this man power by mechanical devices. For many years, conveyors had been in operation in various industries, but now a new stimulus brought out a number of new developments and many applications. About 1916, industries in America were called upon to produce war materials to aid in the conflict on the continent of Europe. Executives will remember how quickly the effect of reduced immigration and increased production was felt, particularly in a shortage of common labor. Up to this time, these executives had been more or less backward in applying mechanical methods to the transportation of materials within the plant, as cheap common labor had always been plentiful, but the new and urgent demands necessitated immediate installations. The experience gained between the years 1916 and 1920 in the application and use of materials handling equipment has shown that much human effort can be conserved and applied to other operations by employing mechanical devices to handle materials instead of handling them by hand.

Immigration has been at a mini-



Fig. 2. The sheet metal industry, or industries where sheet metal is used in quantities, employ many forms of cranes, cars, stock racks, etc., in order to reduce their handling costs.



Fig. 3. Warehouses and docks have many handling operations where skids and lift trucks are economically employed.

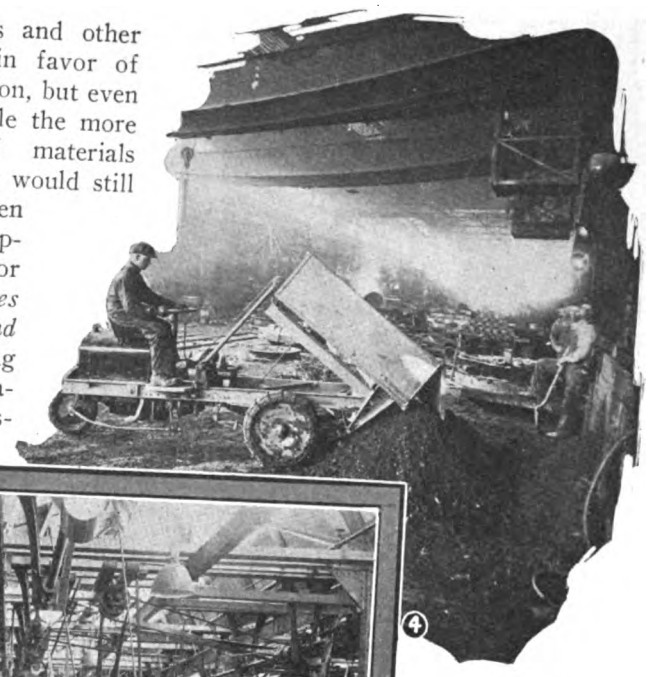
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mum since 1914 and now laws are being passed which will keep it at a minimum, thereby making it necessary for Industrial America to turn to its proper source of cheap labor, namely mechanical power, of which materials handling equipment is one of the biggest factors. The proper application of this factor is now being investigated by many executives, enginering societies and others, and the solution of a number of difficult problems is the result. In addition there is brought about lower production costs and the elimination of waste as well as a conservation of common labor.

Not so many years ago, each installation of materials handling equipment was more or less of an experiment, but today there is hardly an industry that has not installed one or more pieces of this equipment and the money savings effected by the installation has been added to industrial profits. It is the profits of industry that affect the economic life of the nation and therefore increased profits are greatly to be desired and any factor which tends in this direction should be investigated and given serious consideration.

Many executives and other organizations are in favor of increased immigration, but even if this were possible the more extensive use of materials handling equipment would still go on, for it has been found that this equipment has three major advantages, *it saves money, time and space,* money being saved by reduced labor costs. To illus-

Fig. 4. Foundries employ overhead traveling cranes, industrial cars operating on rails, gasoline driven dump body trucks and other devices for handling materials in the production of castings.



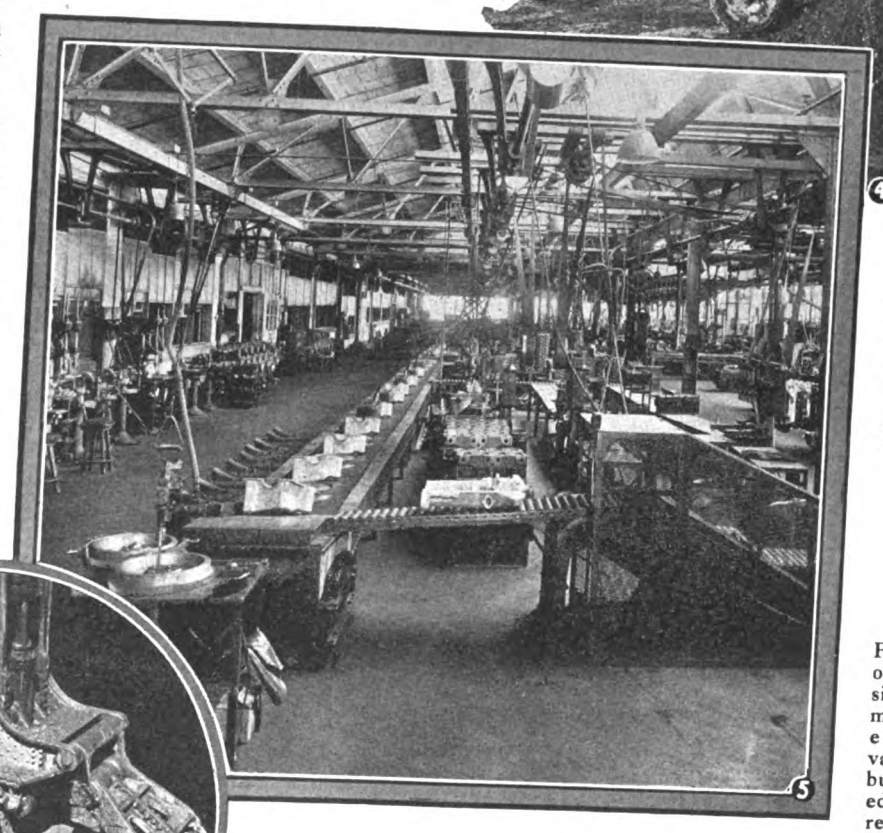


Fig. 5. The Automotive Industry and its success with quantity production has been largely due to the extensive use of all types of conveyors and elevators.

Fig. 6. Close-up view of the seven-ton scoop bucket shown in Fig. 20.

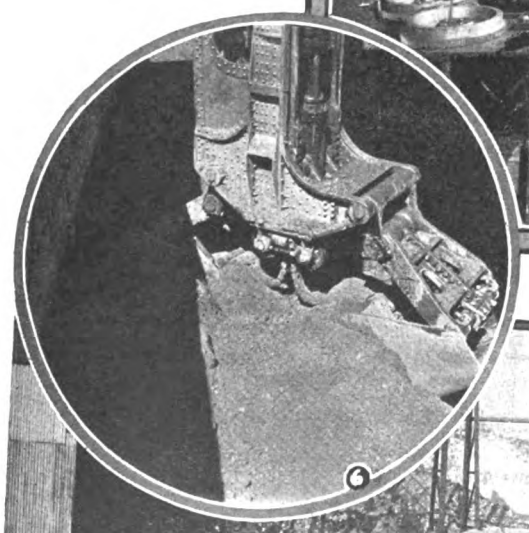
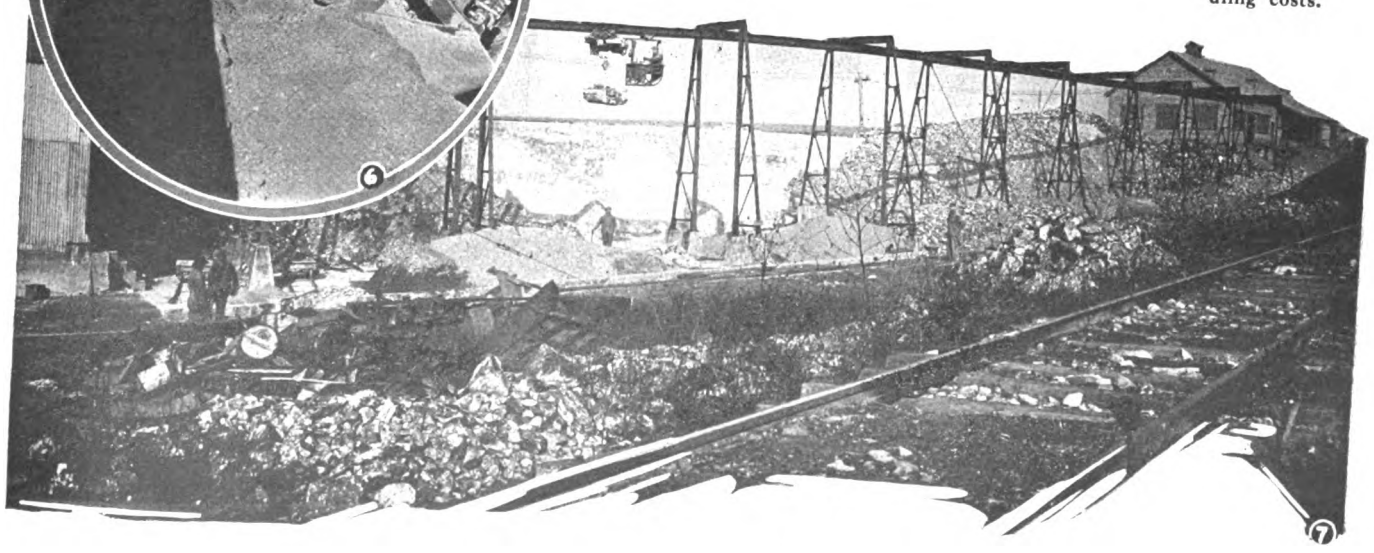


Fig. 7. In handling ore, limestone and similar materials, mono-rails equipped with various types of buckets have speeded up the work and reduced the handling costs.



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trate this point that regardless of the immigration question, materials handling methods will continue to be applied, we refer to Fig. 21, where American conveyors have been shipped from this country to compete with the cheapest labor in the world. If industry abroad is willing to buy our materials handling equipment to assist labor in a market where there is no need for conservation it behooves American industrial executives to investigate their handling problems and apply mechanical means of transportation wherever possible.

There is a tendency on the part of executives to feel that their industry is the one industry that cannot use mechanical equipment for handling materials and with this in mind the illustrations shown herewith have been selected at random in order to point out that all industries can use one or more types of materials handling equipment on many operations. In these pictures we see equipment operating in chemical and gas plants, sheet metal shops, on docks and piers, in foundries, machine shops, raw material storage yards, metal stamp-

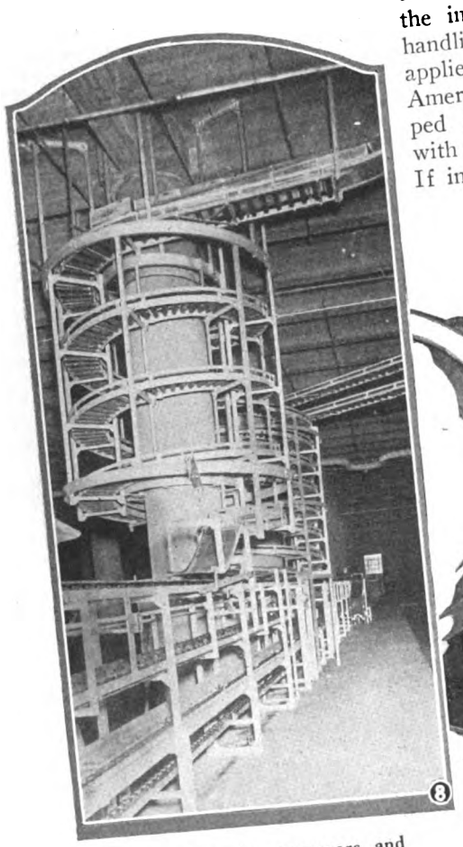


Fig. 8. Gravity conveyors and gravity roller spiral chutes, also mechanical conveyors, play an important part in the loading of cars at this large beverage bottling plant.

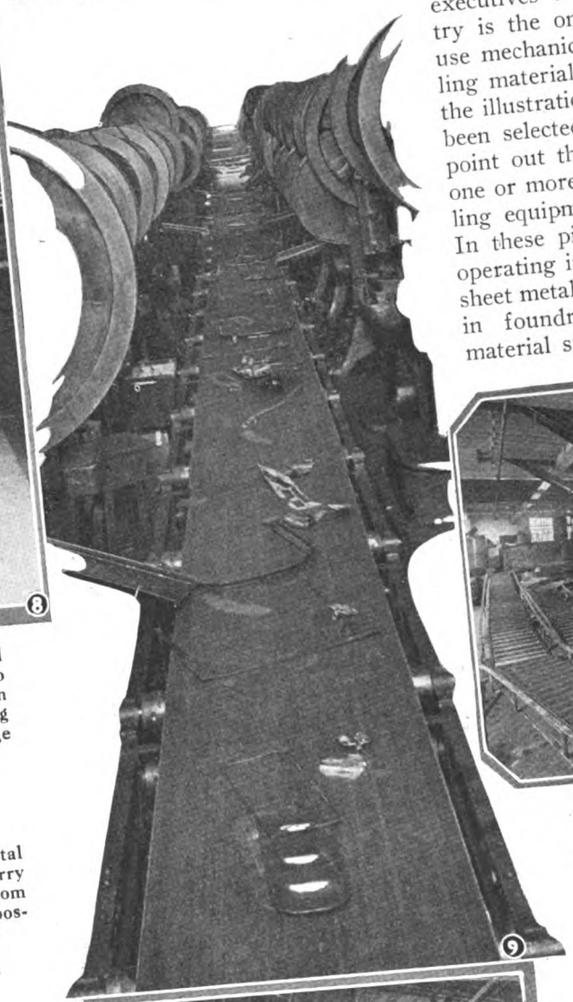


Fig. 9. In the stamping of metal parts it is important to carry the finished products away from the machines as quickly as possible.

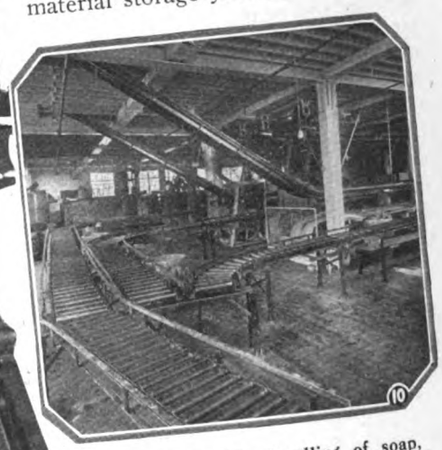


Fig. 10. The handling of soap, in many forms, is now done by various mechanical conveyors. This shows a few employed in one large soap factory.



Fig. 11. The jib pillar crane, the electric driven chain hoist and the electric lift truck are here shown assisting in the production of electric motors.

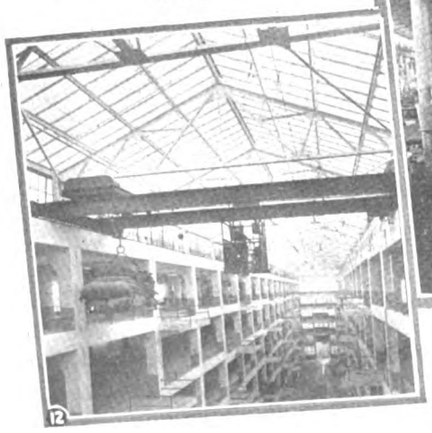


Fig. 12. In warehouses, machine shops and production buildings, the crane bay is an important factor. Note the overhanging unloading platforms on all floors.



Fig. 13. In machine shops and foundries, industrial lift trucks, operated by gasoline and electricity, have greatly reduced the cost of production.

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ing works, bottling works, paper mills, on construction work, for the loading and unloading of ships, road building, in warehouses, soap plants and other industries.

Before the advent of portable conveyors shown in Fig. 1, the material in the pile used to be placed in the tanks by means of buckets and a shovel gang. This method of operation was costly and slow but the use of materials handling equipment as illustrated has brought about better working conditions, quicker operation, and reduced labor costs. Similar belt conveyor equipment is shown in Fig. 21 on a different operation, where it is necessary to transport and trim the coal pile so as to increase storage facilities under the unloading trestle. Fig. 23 shows how contractors are using portable belt conveyors in order to increase their profits on road building without increasing the cost to taxpayers. Here the sand, cement and other materials are placed on the long belt conveyor and discharged by means of an inclined belt conveyor direct to the concrete mixer charging hopper. This use of conveyors permits three men

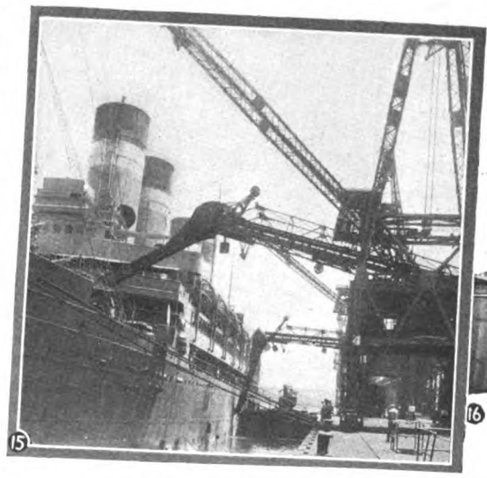


Fig. 15. At one time ships had to wait on the coaling operation, but mechanical devices now deliver coal to ships as fast as they can take it. Each of the loaders shown can deliver 250 tons per hour.



Fig. 16. On the piling of materials in the chemical plants, warehouses, etc., the tiering machine has been found efficient.



Fig. 14. To move paper in this plant without seriously delaying production operations it was found necessary to employ the ceiling for transportation.

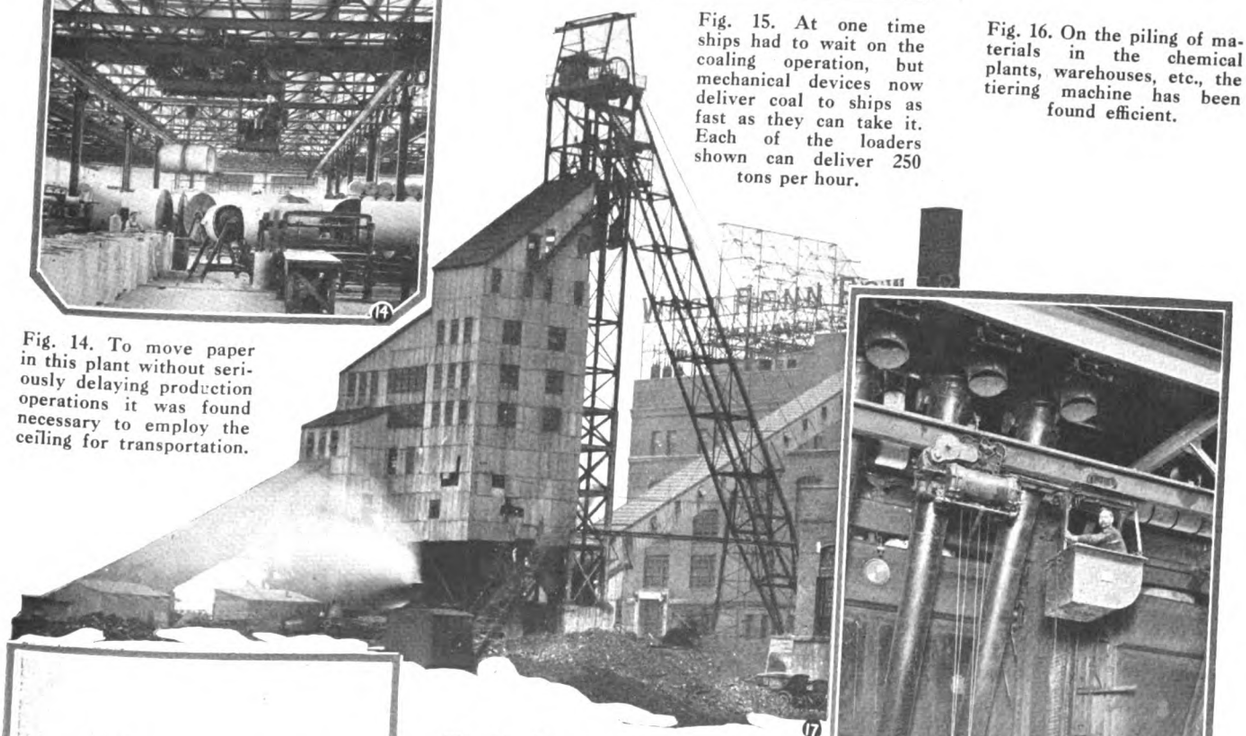


Fig. 17. The central power station uses elevators, conveyors, skip hoists and locomotive cranes in order to produce cheap power to drive similar equipment in industrial plants.



Fig. 18. On construction work in stone quarries and cement plants are many installations of elevators, conveyors and industrial cars similar to those shown.

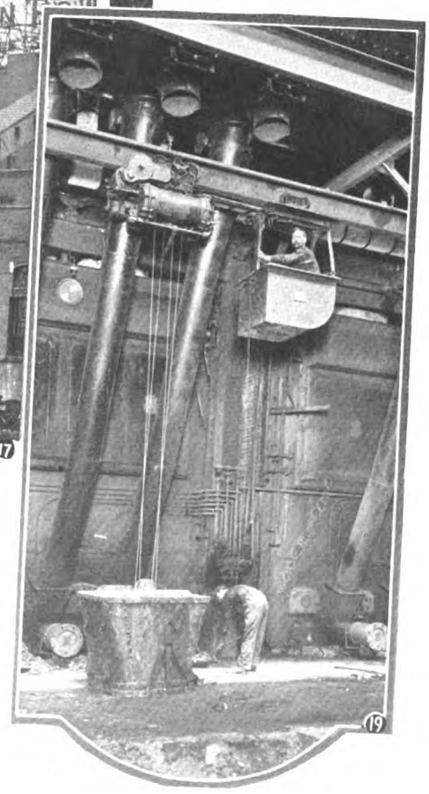


Fig. 19. In handling coal from mines to the ash pile all forms of materials handling equipment are employed.

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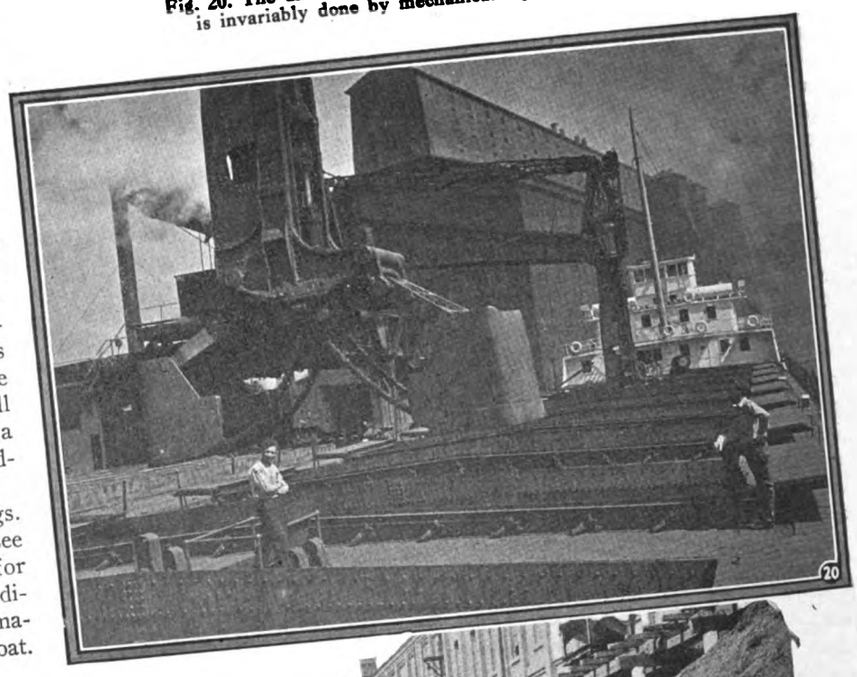
to do the same amount of work as formerly required approximately fifteen men equipped with a number of shovels and wheelbarrows.

The readers all know that the costs of finished products to consumers not only include the cost of production but also include the cost of handling and transportation from point of growth or manufacture to the point of consumption. Thus we find that not only is industry interested in reduced handling costs but every individual is also directly interested, as they are paying in the purchase price for inefficient methods and they will benefit by a lower purchase price if a savings can be made on each handling operation.

To illustrate, we will look at Figs. 6, 15, 20, and 22, in order to see what materials handling is doing for the shipping industry; also for individuals and industries that have materials delivered or shipped by boat.

(*Continued on page* 53)

Fig. 20. The unloading of ore at Great Lake ports is invariably done by mechanical equipment.



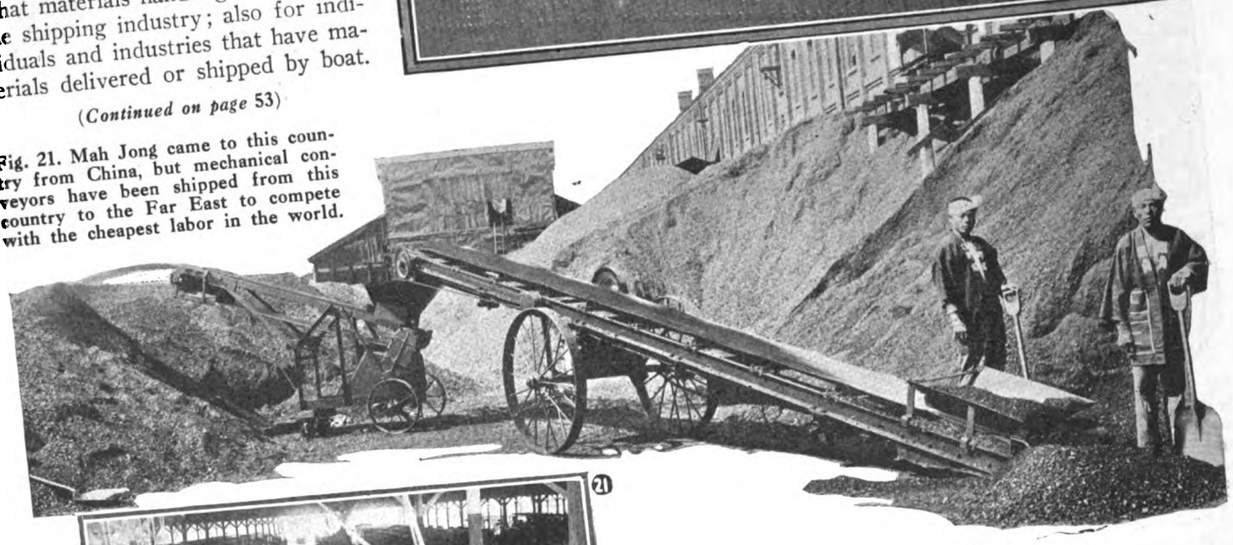


Fig. 21. Mah Jong came to this country from China, but mechanical conveyors have been shipped from this country to the Far East to compete with the cheapest labor in the world.

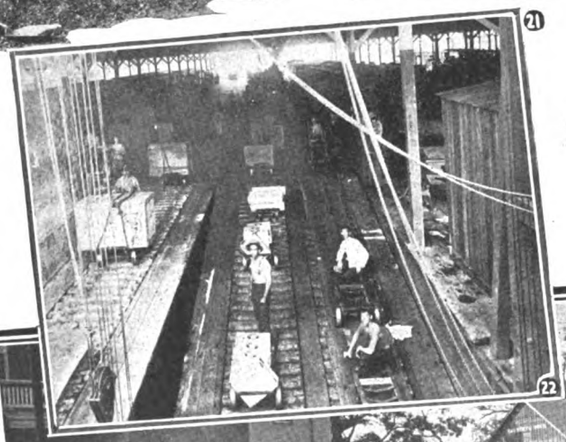
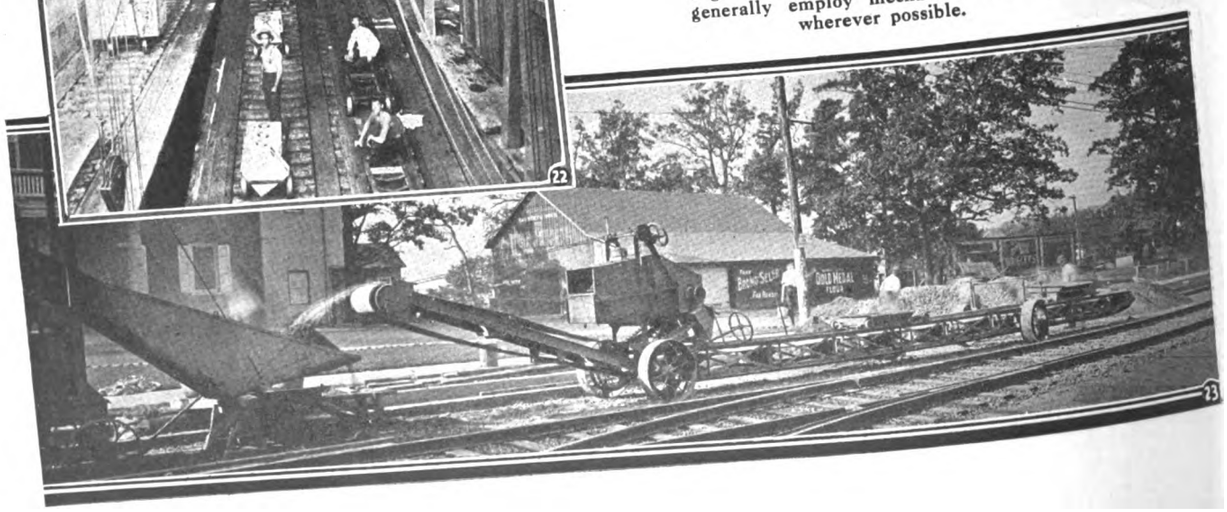


Fig. 22. Conveyors built into dock ramps take the heavy work out of handling miscellaneous freight.

Fig. 23. Road builders and contractors generally employ mechanical conveyors wherever possible.



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Barring the Gates

Introducing the Father of Immigration Restriction, and Commenting on Its Effects

THAT our new understanding of the immigration problem has borne fruit in the restrictions which will go into effect on the 30th of June, is due in large measure to the work of Hon. Albert Johnson, whose portrait appears on this page.

There has been much propaganda, of varying degrees of disinterestedness, for and against restrictive measures. Perhaps it is not amiss to quote here from a recent speech of the man who, by reason of his work as chairman of the House Committee on Immigration and Naturalization, is qualified to appraise the subject justly. Said Mr. Johnson:

"Our new immigration law is written for all who are now within the United States, for all who come under the protection of our great Constitution, which begins with the magnificent words of the preamble, 'We the people of the United States'—people, not citizens. We are all the children of immigrants, and our new immigration bill as written makes it clear that it makes no difference whether our ancestors came on the *Mayflower* or whether they missed the first boat.

"Now that real restrictive immigration legislation is assured, our next step is the development of real Americanization. It is our duty to reach out to every last person in the United States, of whatever race, to take him by the hand and let him know by word and deed that we are for him and that he must be for us."



Hon. Albert Johnson, chairman of the House Committee on Immigration and Naturalization, may be called the Father of Immigration Restriction. Through his efforts Congress passed the 3 per cent. quota law of May 19, 1921. This law goes out of effect on the 30th of June of this year, and is replaced by an even more severe restriction.

From the standpoint of the industrial executive, the subject divides itself into two heads. The first is the effect of immigration restriction on labor. The second is the effect on the use of labor-saving machinery.

The subject of labor has always occupied a place of first importance in the minds of American industrial executives. American labor has never been cheap labor. Cheap labor we have had, in certain industries and localities, but it has been European cheap labor and not American—the exception and not the rule, a temporary and local condition, not permanent, or general, or secure.

Because our labor has not been cheap, we have had to give a great deal of thought to labor-saving *machinery*—the substitution of mechanical power to make the production of high priced American workmen equivalent in value to that of the several European workmen whose daily labor can be purchased by the American workman's daily pay. Thus America has become, through the economic pressure applied by high wages, the world recognized home of improved machinery and power production.

From the standpoint of labor supply, and with regard to economic rather than political effects, the reduction from 3 to 2 per cent. and the change from the 1910 to the 1890 base combine to cause a net annual decrease of approximately 150,000 wage-earning immigrants. At an average daily wage of $3.50 (which is admittedly low) this labor amounts in money to the equivalent of more than half a million dollars per day, or close to one hundred and fifty million dollars per year. Assuming

(*Continued on page* 100)

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Systemizing Motor Production at Schenectady

By John H. Van Deventer

THE Induction Motor Department of the General Electric Company is one of the decentralized sections of the Schenectady Works, having its own engineering, drafting, production, cost, order and stock and factory organizations under the direction of a superintendent, all located in one manufacturing group. These various divisions of work are each controlled by a staff officer of the plant, but their efforts are coördinated through an engineer-manager in charge of the department. By this arrangement, all those directly responsible for the quality of the apparatus, its cost, shipping promises and capital lockup are brought into a controllable manufacturing unit.

Only the larger sizes of induction motors are made at Schenectady. These range in capacity, however, from around 10 horsepower to 22,650 horsepower; in size, from 18″ to 28′ in diameter, and, in weight, from 400 lbs. to 400 tons.

On the one hand, the problems of manufacture involve quantity production of standardized parts and, on the other, machining and assembling large, heavy parts. In capacities over 250 horsepower, all motors are made to order, while, below this, certain ratings can be carried in stock, the proportion of stock to special motors varying from about four-to-one in the smaller sizes up to one-to-four at 250 horsepower.

Between 10 and 250 horsepower, there are thirteen standard horsepower ratings. These are made for approximately eight different poles or speeds, both horizontal



Fig. 1. Forming stator coils. The wire is first wound by boys into a flat coil of the required number of turns, the ends cut to length, and wires tied by hand with cord to hold the coil in shape for moulding.

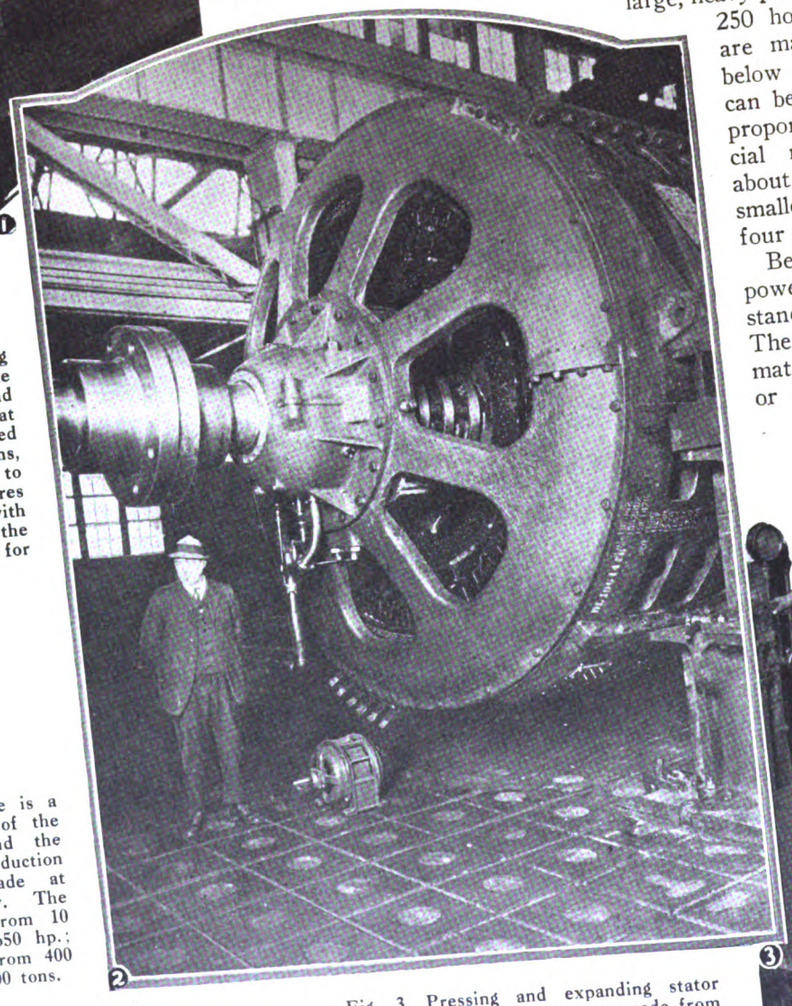


Fig. 2. Here is a comparison of the smallest and the largest induction motors made at Schenectady. The range is from 10 hp. to 22,650 hp.; weighing from 400 lbs. to 400 tons.

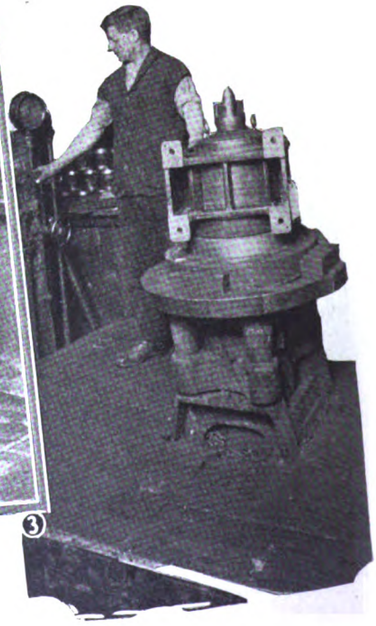
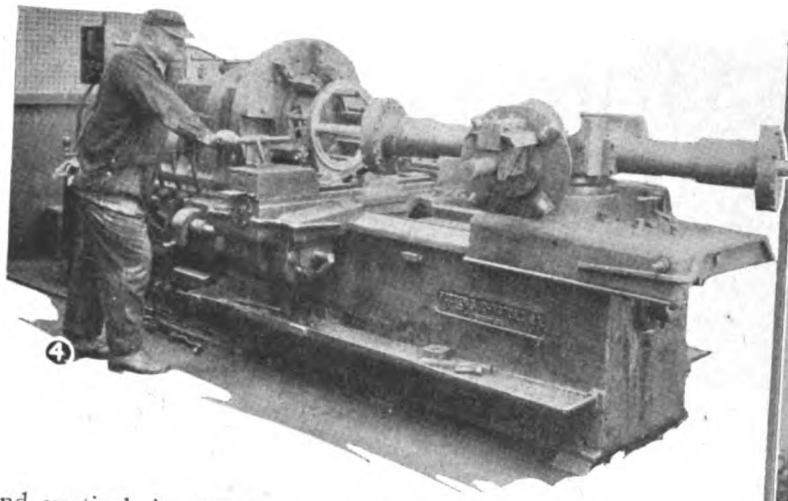


Fig. 3. Pressing and expanding stator punchings. The segments are made from a special grade of thin steel.

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and vertical, in two forms—squirrel cage and collector ring—for circuits of 60, 50, 40 or 25 cycles and 2200, 550, 440, 220 or 110 volts, and both three phase and two phase. The total number of varieties of ratings, therefore, equals the product of these different combinations, thus:

H. P. Ratings		Poles		Horizontal or Vertical		Form		Cycles		Volts		Phases	
13	x	8	x	2	x	2	x	4	x	5	x	2	=16,640

Such a list of ratings would include only those of standard construction, and it would be enlarged by including the special lines of motors made for special service, such as elevator, crane, coal mine, steel mill, attrition mill, textile mill, etc., so that the number of varieties of ratings is almost unlimited.

Only about 600 of these ratings are sold in sufficient quantities or at a rate even enough to be made for stock in advance of

Fig. 4. The machining of stator spiders is so arranged as to coördinate the functions of the completed piece; the feet bottoms being first milled to provide a mounting surface for the boring mill.

Fig. 6. At the right—girls are employed in the winding of flat wire coils.

Fig. 5. Girls apply the insulation to stator coils, in the form of varnished cambric cloth wrappings, and linen tape, later filled with varnish.

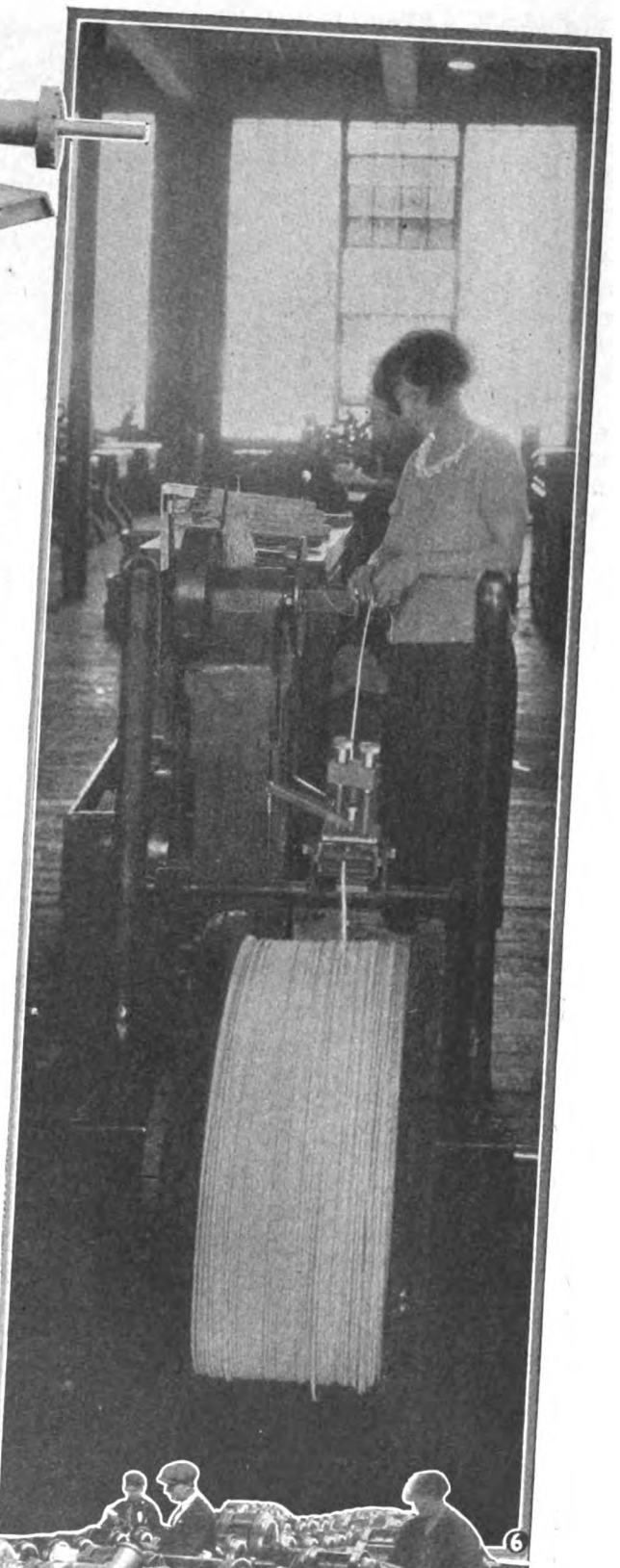
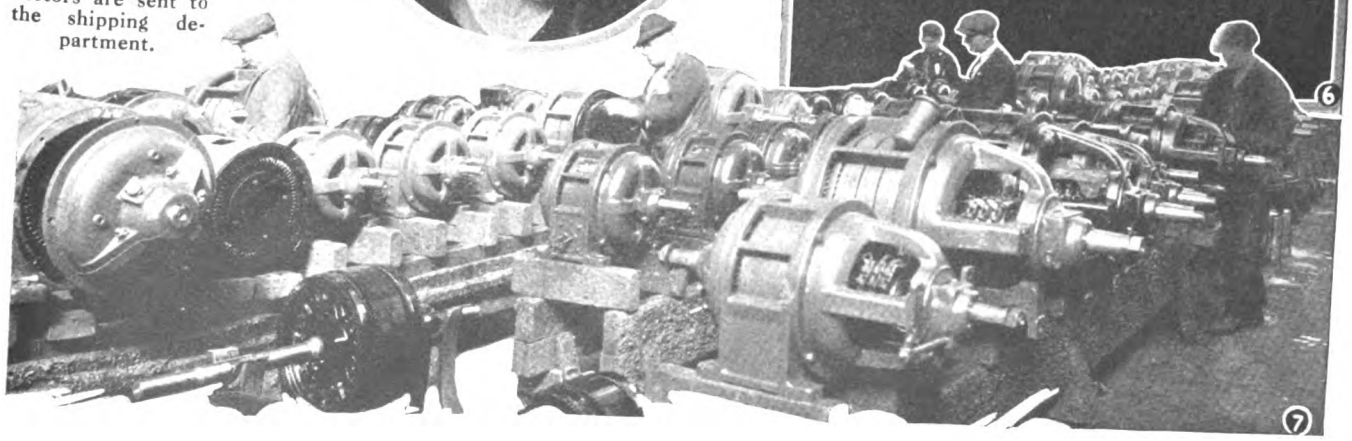




Fig. 7. These men (below) are giving the careful final inspection preliminary to painting, after which the motors are sent to the shipping department.



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actual orders. These ratings do, however, include the greater part of the standard component parts from which a very large number of other ratings can be made by different selection or arrangement of component parts.

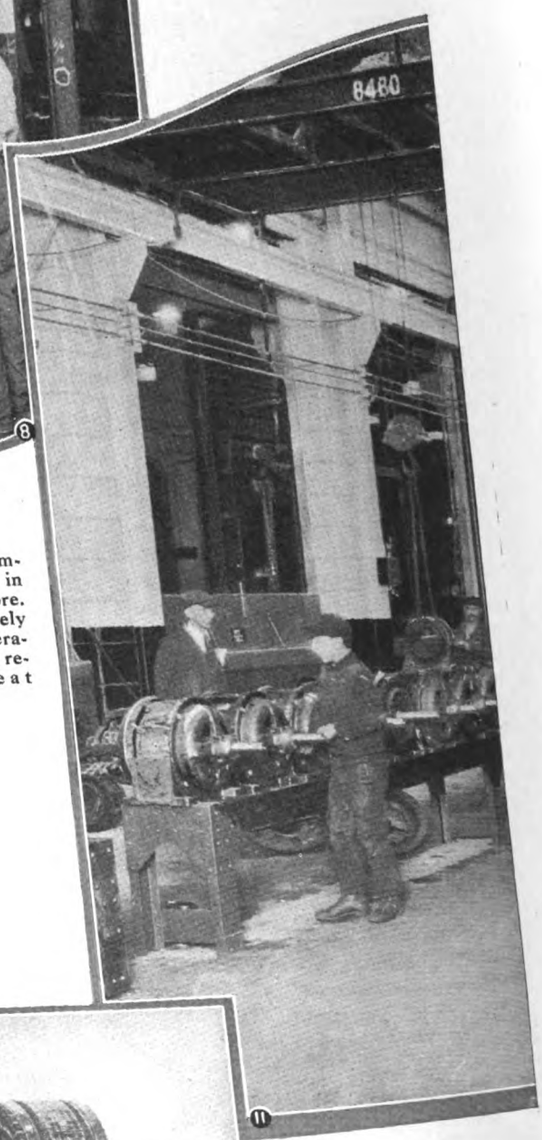
The problem of making the standard motors can, therefore, be largely reduced to a consideration of the component parts. The design must be worked out so that each part can be used in a great variety of ratings. For example, the punchings, which require very expensive die equipment, must be designed in order to allow the slots to accommodate many different coils for the numerous voltages, cycles, poles, etc. Likewise, the different castings must be reduced to the minimum in variety, not only to save pattern and moulding equipment, but, still more im-



Fig. 8. Grinding a motor shaft; work which requires constant accurate gauging.



Fig. 9. Assembling coils in the stator core. This is entirely a hand operation and requires great care.



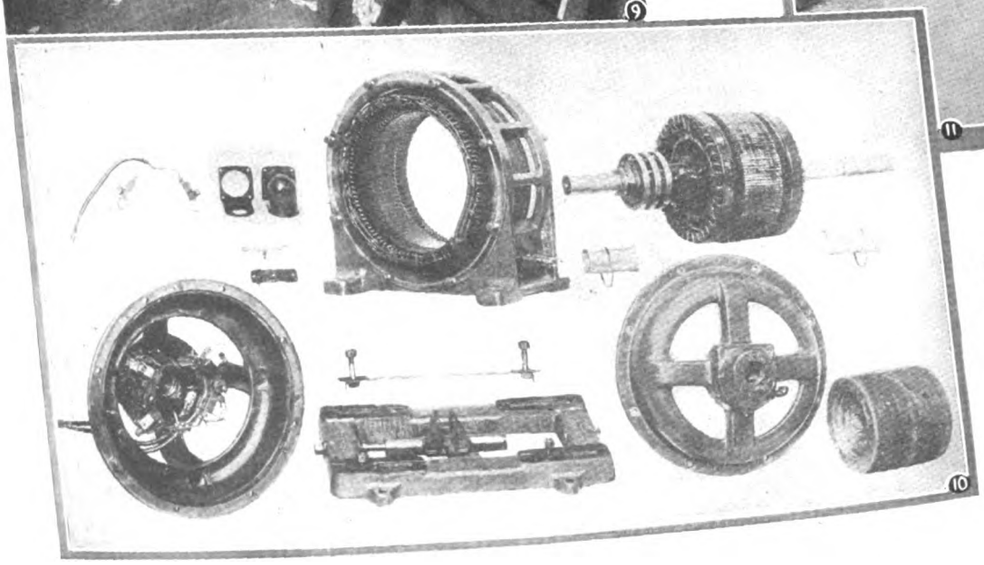


Fig. 10. At the left are shown the major component parts of a standard collector ring motor. Assembled stator and assembled rotor are at the top of the illustration.

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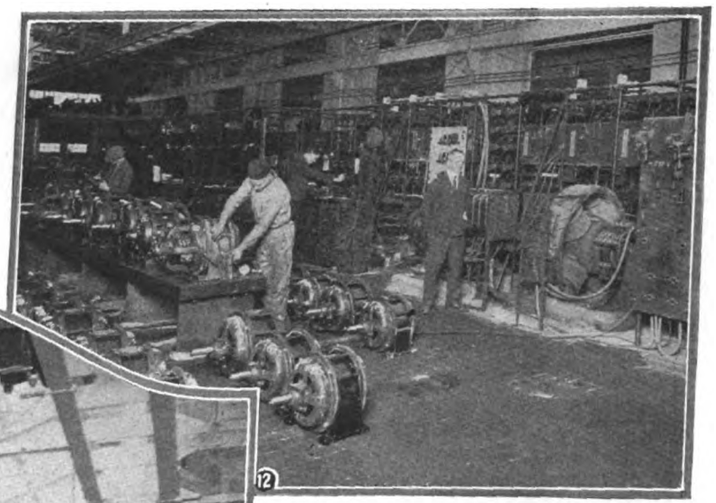


Fig. 12. The electrical tests of finished motors require elaborate apparatus and skilled men.

portant, to standardize manufacture.

From a manufacturing standpoint, the problem is to make use of special machine tools, jigs and fixtures only in so far as their use tends to reduce the cost of manufacture and no further. In other words, it is important to make the parts on standard machine tool equipment unless the quantity justifies special equipment.

One of the most interesting features, however, is the regulation of production schedules and the control of stock and ordering. The production of motors is based, not on the individual manufacture and stocking of semi-finished parts, but upon a scheme of quantity production of complete standard machines scheduled and regulated over a definite period of time. This production scheme might more properly be

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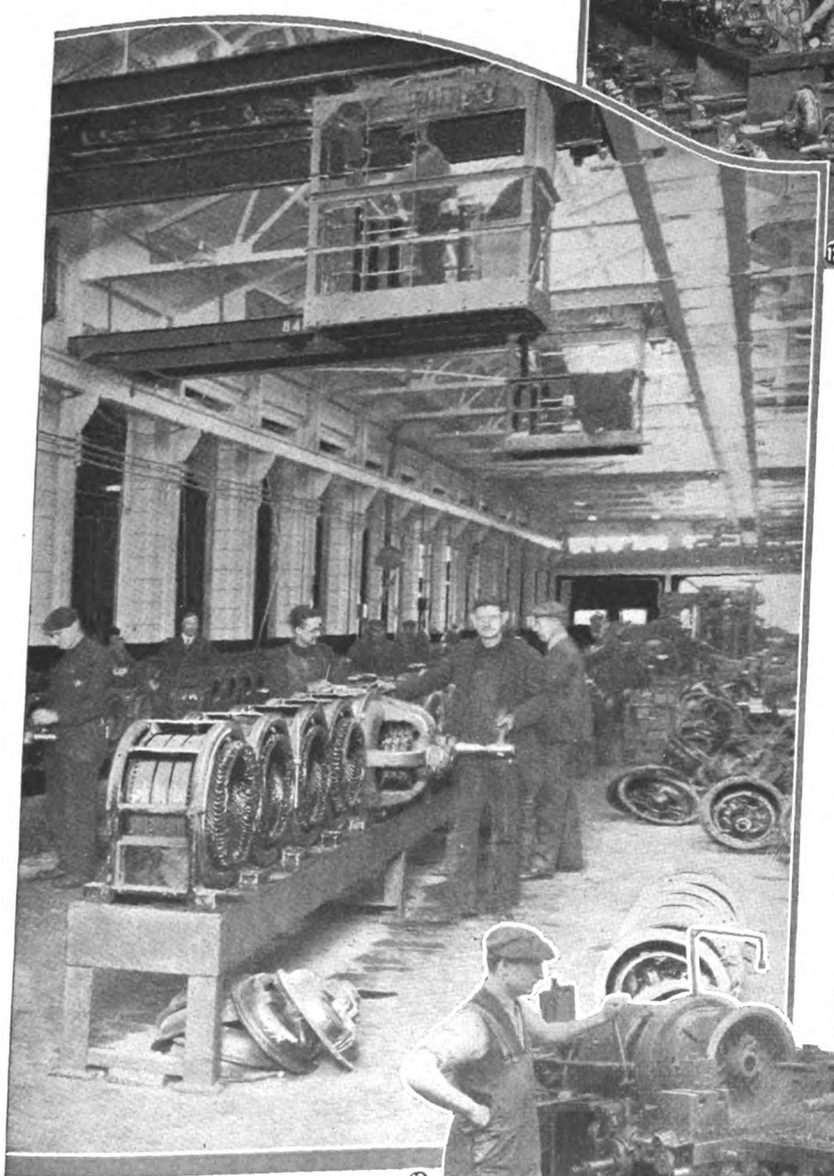


Fig. 11. Above is a view of the work of final assembly of complete motors. They are then ready for testing, inspection and painting.

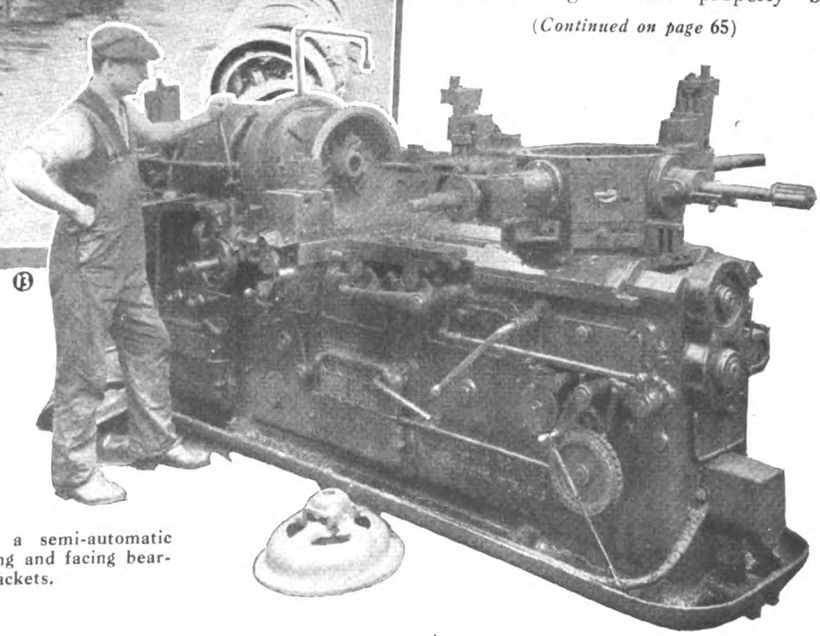
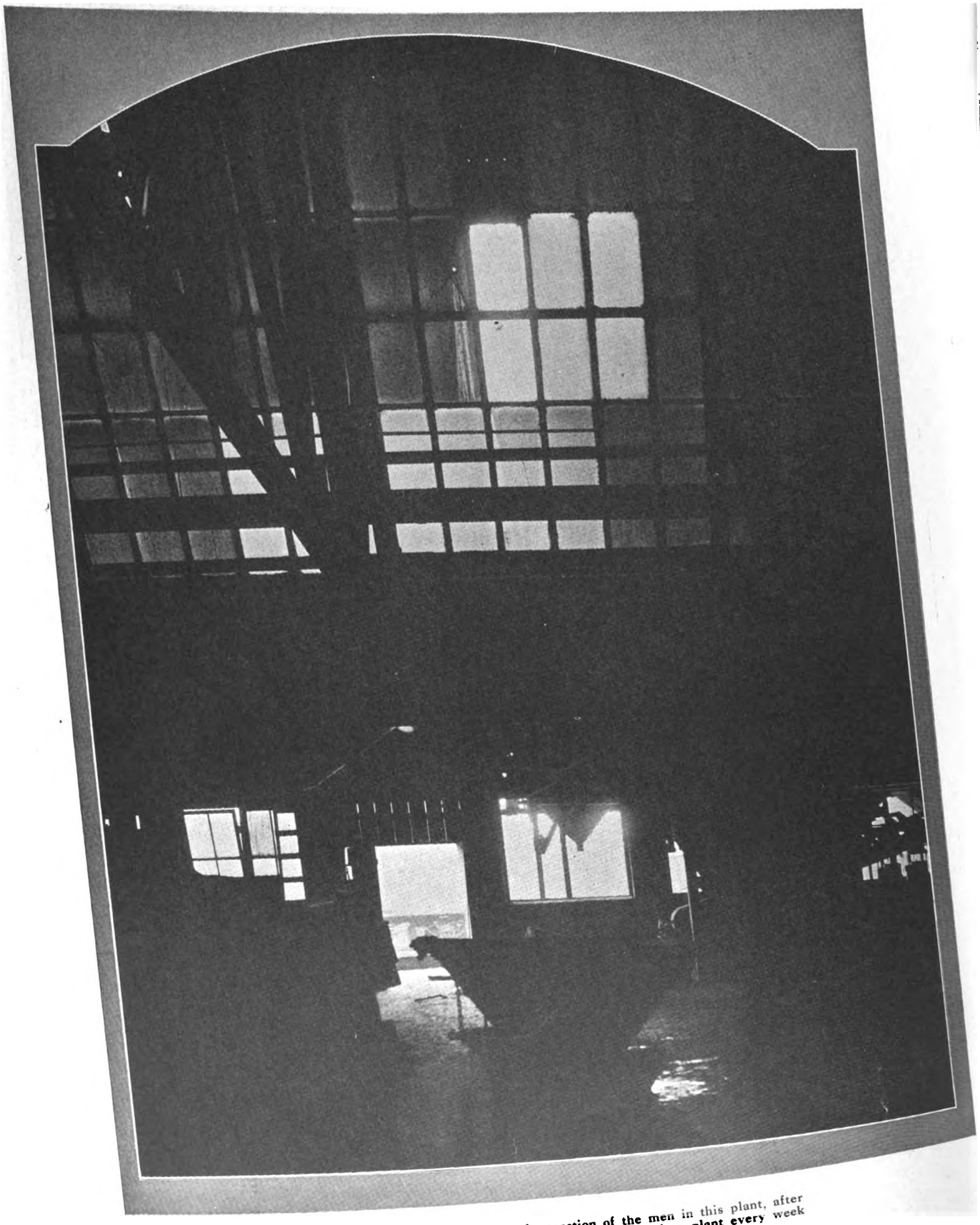


Fig. 13. Here is a semi-automatic lathe, boring, turning and facing bearing brackets.

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It would be interesting to know the reaction of the men in this plant, after the rest of the skylight had been cleaned. In the modern plant every week should be "clean-up week."

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Industrial Housekeeping

The Work of the Sanitation Department

By William G. Ziegler

PLANT sanitation is a broad classification covering the equipment, methods and materials necessary to preserve the health of the men. There is no question but that good sanitation pays, and if a plant is to operate at its highest efficiency, good sanitation is absolutely necessary. A clean, cheerful plant is usually an efficient plant, because the good health of the workers is bound to affect the amount and quality of the output. Most men spend the major portion of their waking hours at work and the conditions under which they work, in the various plants, affect their health to a larger extent than most people realize. It is to the employer's benefit to have a clean, sanitary plant because of better efficiency, and it is to the benefit of the men because of their better health. However, in spite of this mutual gain, cleanliness has not been given the attention it deserves.

It is easier to hold good help in a plant having good sanitation and it will attract more good help. A plant having drinking fountains, lockers, individual wash bowls, good toilet facilities and shower baths for departments needing them will have contented workmen and a high degree of efficiency. A shower bath has a wonderfully invigorating effect on a man who is tired and dirty and whose pores are all filled with perspiration and dirt. State codes usually specify the minimum requirements of urinals and closets, but it is best to have more rather than not enough, because if the men lose time waiting their turn in a toilet room the loss will more than cover a little added equipment.

When women are employed in the plant, entirely separate washroom and toilet room accommodations are necessary for them. As a rule the installation of up-to-date equipment for one group makes it necessary to provide as good accommodations for another group so that the general trend is toward complete high





Figs. 1 and 2. There is no excuse for leaving oily waste or cleaning rags where they may constitute a serious fire hazard. The use of approved containers is both a safeguard and a convenience.

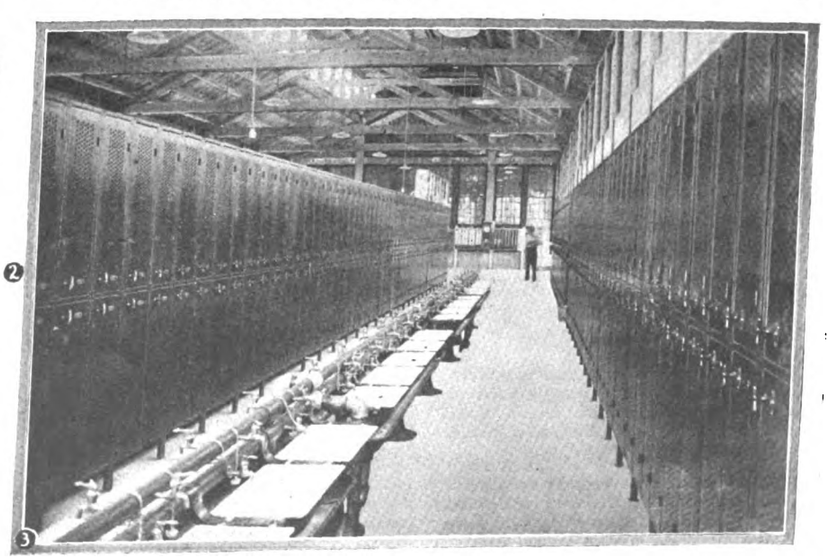


Fig. 3. At the right is a well arranged locker room and washroom with adequate facilities for a large force of men.

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grade sanitation. The cost of installing equipment often seems high but when the advantages are enumerated the decision is easy to make. The loss of time by trained men when they cannot be spared is the greatest inducement to managers to do everything possible to protect the health of the workers so that production schedules may be maintained.

Floors must be cleaned periodically no matter what the nature of the work, but the cleaning of floors in screw machine departments and other places having similar conditions constitutes a real problem. Oily floors are dangerous because they are slippery and if of wood soon become oil-soaked fire hazards that should not be tolerated. Regular scrubbing and mopping schedules must be maintained in order to overcome these conditions. The cleaning solution used should cut and remove the oil and grease without affecting the floor.

The general cleanliness of

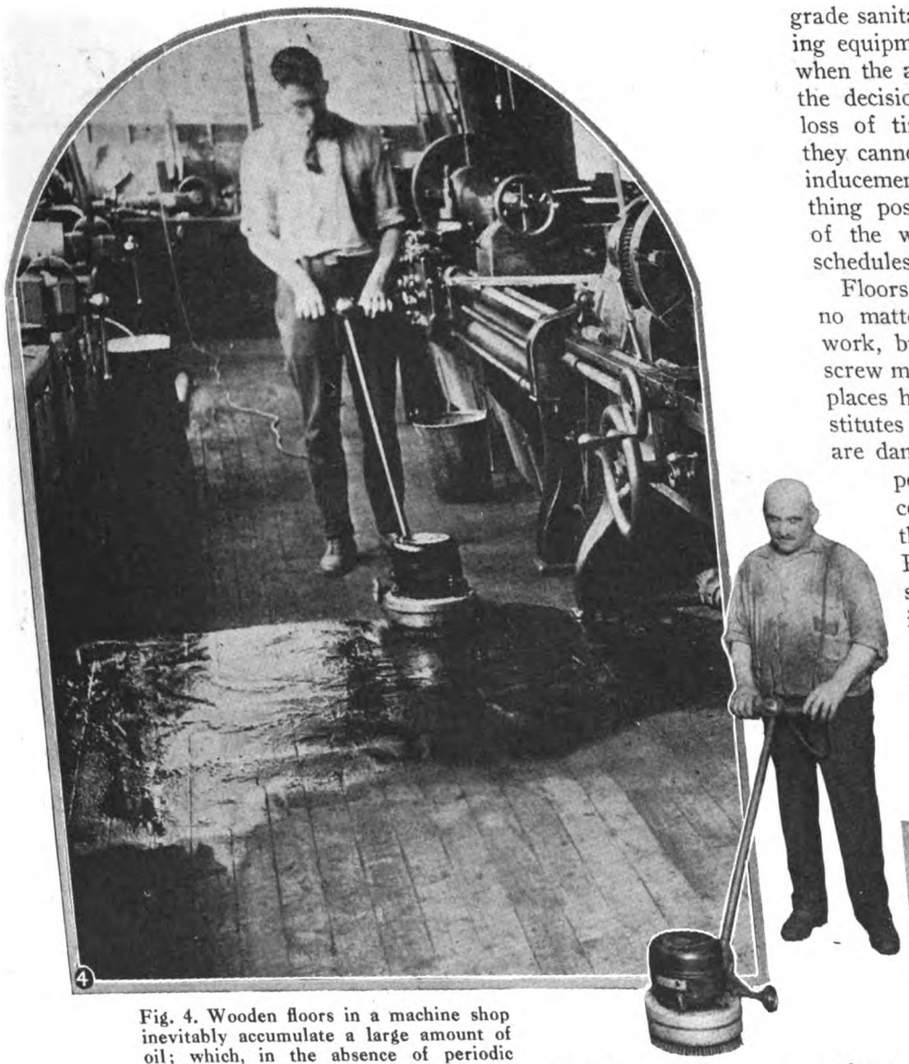


Fig. 4. Wooden floors in a machine shop inevitably accumulate a large amount of oil; which, in the absence of periodic thorough cleaning, make such departments a ready prey to fire anywhere within the plant.

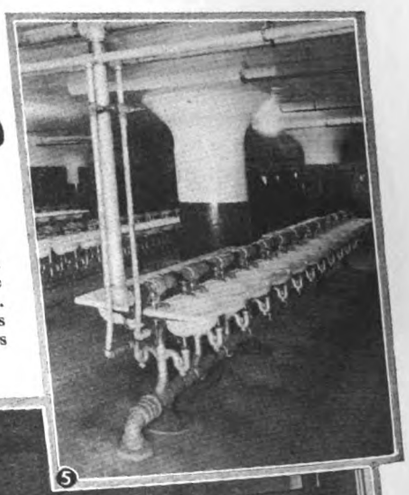


Fig. 5. It is not many years ago that a bucket and a dirty rag constituted the only means for the men to wash up. Modern management, however, has learned that such installations as this are a paying investment.



Fig. 6. There is scant excuse nowadays for the germ-contaminated glass or cup, where several persons obtain their drinking water from the same faucet.



Fig. 7. A good deal of the modern idea of cleanliness had its conception in the medical department; now a recognized indispensable adjunct of even the moderate size industrial plant.

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the plant has a very important psychological effect on the workmen; it makes them neater with their work, as they gradually have impressed on them clean floors, clean windows, and racks for tools and equipment, so that their machines and benches are cleared for action and there is a place for everything and everything is in its place. At the plant with which the author is connected a monthly prize is given to the cleanest department and the rivalry to get this prize has had a telling effect on the general appearance of the plant. The judges are the foremen of all the departments and they vote during the twice-a-month inspection trips.

Cleaning of the machinery and equipment is a very important item in proper maintenance. A certain time is set aside each week, usually on Saturday, just before closing time when all machine operators thoroughly clean their machines. This work should be thoroughly done be-

(*Continued on page 74*)

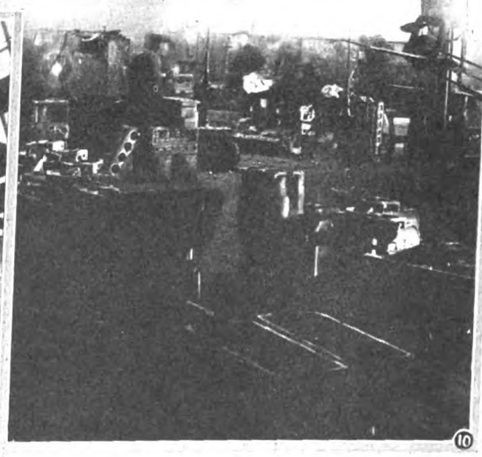


Fig. 8. Containers such as this, for oil, etc., soon pay for themselves in saving of waste and reduction of fire risk.



Fig. 9. Accessibility and cleanliness should be the keynote in the installation and maintenance of drinking fountains.





Figs. 10 and 11. Although these two pictures may seem an extreme example, they are an actual example of what a difference it makes when skylights are permitted to accumulate dirt for any length of time. It certainly costs less to keep them clean than to pay for artificial light.

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Is "Character Reading" Mere Guess-Work?

Intelligence Tests Fail to Support the Prevalent Ideas that Handwriting and Features Are an Index to Character

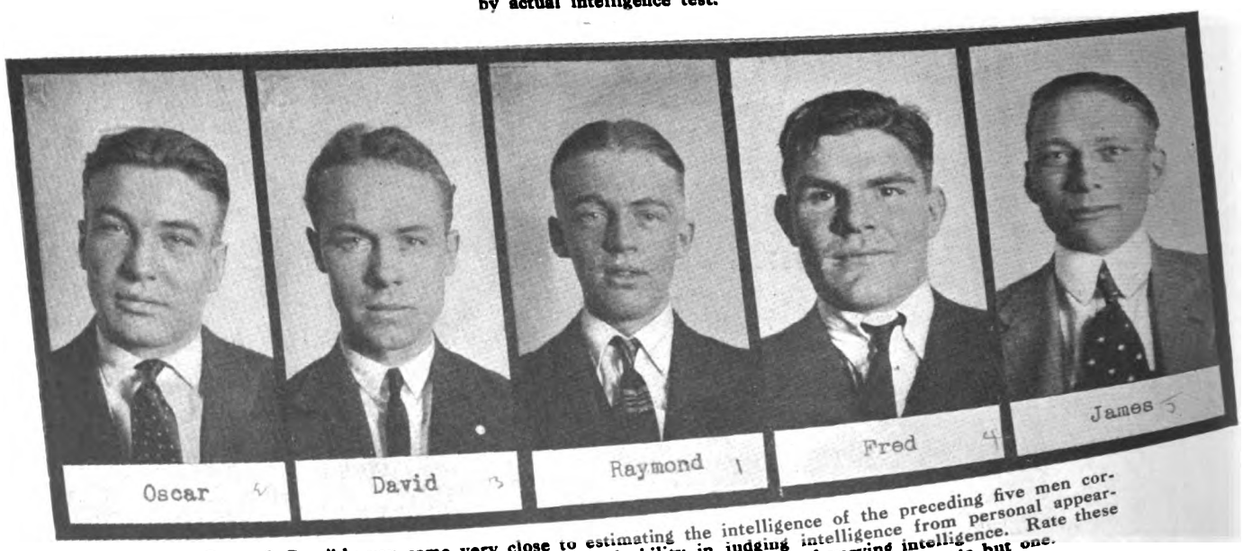
By Donald A. Laird, Ph. D.

Positions—Industrial

WANTED—OFFICE ASSISTANT FOR ROUTINE AND SOME MINOR EXECUTIVE WORK. COLLEGE GRADUATE PREFERRED; OPPORTUNITIES FOR ADVANCEMENT.
XBJ % GAZETTE

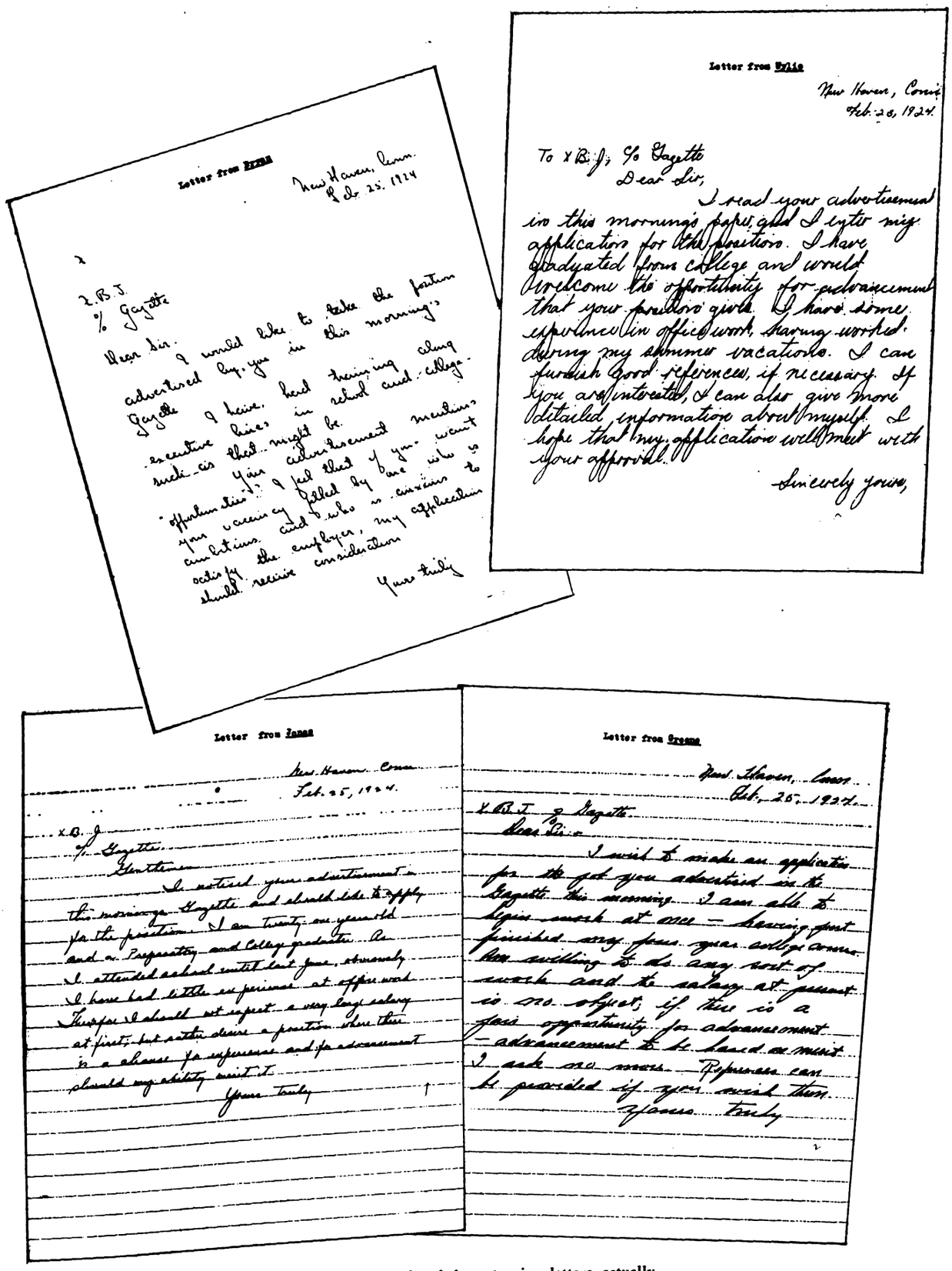


Group 1. Above are the pictures of five men. Assume them to be applicants for the position advertised above. Pick out the most intelligent, and write "1" next to his name; mark the next most intelligent "2," and so on. After you have thus rated them by intelligence, turn to the second following page for the correct rating by actual intelligence test.



Group 2. Possibly you came very close to estimating the intelligence of the preceding five men correctly. Does this mean that you have unusual ability in judging intelligence from personal appearance? Hardly. Here are five more camera studies of young men of varying intelligence. Rate these as you did the others, before referring to the correct rating on the next page but one.

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Letter from Yale

New Haven, Conn.
Feb. 26, 1924.

To X.B.J., % Gazette
Dear Sir,

I read your advertisement in this morning's paper, and I enter my application for the position. I have graduated from college and would welcome the opportunity for advancement that your position gives. I have some experience in office work, having worked during my summer vacations. I can furnish good references, if necessary. If you are interested, I can also give more detailed information about myself. I hope that my application will meet with your approval.

Sincerely yours,

Letter from [illegible]

New Haven Conn.
Feb. 25. 1924

X
X.B.J.
% Gazette
Dear Sir.

I would like to take the position advertised by you in this morning's Gazette. I have had training along executive lines in school and college such as that might be. Your advancement meetings appeal to me. I feel that I am well qualified by [illegible] your vacancy and who is desirous to advance. And who is anxious to satisfy the employer, my application should receive consideration.

Yours truly

Letter from James

New Haven Conn
Feb. 25, 1924.

X.B.J.
% Gazette.
Gentlemen:

I noticed your advertisement in this morning Gazette and should like to apply for the position. I am twenty one years old and a Preparatory and College graduate. As I attended school until last June, obviously I have had little experience at office work. I hope I should not expect a very large salary at first, but rather desire a position where there is a chance for experience and for advancement should my ability merit it.

Yours truly

Letter from Greene

New Haven, Conn.
Feb. 25, 1924.

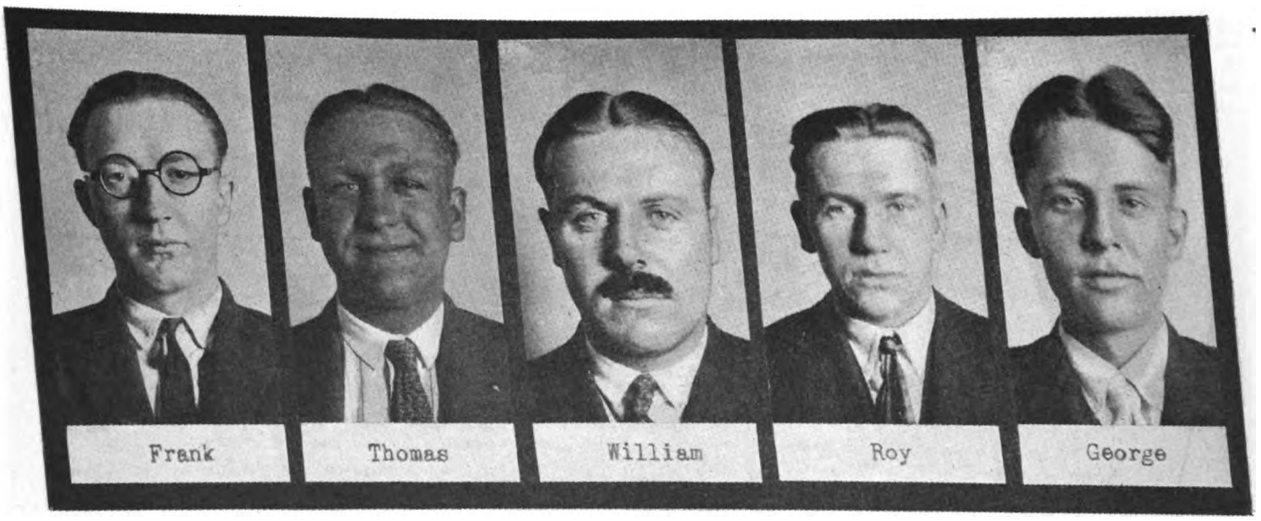
X.B.J. % Gazette
Dear Sir:

I wish to make an application for the job you advertised in the Gazette this morning. I am able to begin work at once — having just finished my Junior year at college. I am willing to do any sort of work and the salary at present is no object, if there is a good opportunity for advancement — advancement to be based on merit. I ask no more. References can be provided if you wish them.

Yours truly

Group 3. Above are reproduced four genuine letters actually received in response to the advertisement shown at the head of this article. From their letters, how would you rate these applicants in the order of their intelligence? After you have marked these letters in accordance with your best judgment, turn to the following page for the correct rating by actual tests of intelligence.

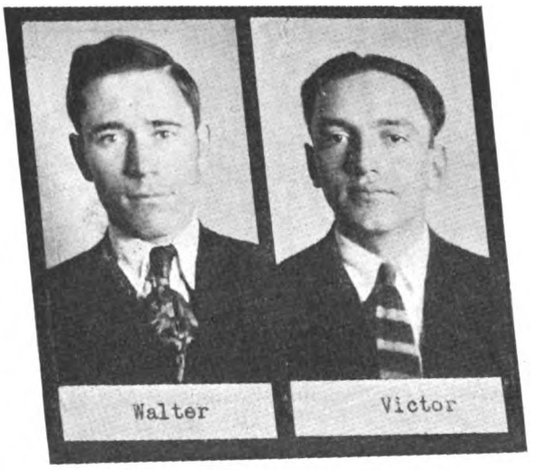
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Group 4. You may raise the point that a photograph is deceptive; but is it any more deceptive than personal appearance? Draw on your own experience with acquaintances: how much is your appraisal of them influenced by the clothes they wear?

These five young men are here dressed very much alike, each with soft collar and four-in-hand tie thus intruding no extraneous differences that might interfere with concentrating your study on their features alone. Suppose you follow once more the procedure of numbering them, from 1 to 5, in the order of their apparent intelligence. Then (and not until then) glance at the bottom of this page for the correct ruling. Do we judge character, or merely surface appearances?





Group 5. Ignoring intelligence, for the moment, can you determine which of these two men is the more conscientious? It may be mentioned that one outranks the other by a considerable margin.

Here are the results of actual scientific tests of the groups shown on these three pages:

Group 1.—Manus (1); Curtis (2); Alfred (3); John (4); Ralph (5).

Group 2.—Raymond (1); James (2); Fred (3); Oscar (4); David (5).

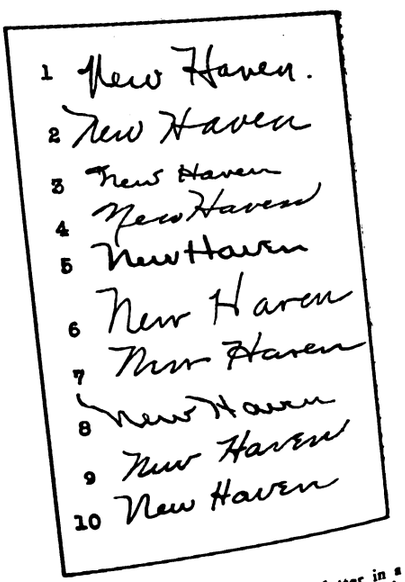
Group 3.—A test of the writers of these letters showed Greene to be most intelligent, Jones second, Wylie third, and Bryan the least intelligent.

Group 4.—It may (or may not) be a surprise to learn that these are the same men as shown in Group 1; with but slight disguise and under different names.

Group 5.—Walter is the conscientious one.

Group 6.—Lines 3, 5, 7, 9, 10 were written by men; the others, by women.

The advertisement at the left is undoubtedly sincere. But there is not one valid or acceptable scientific reason for the occupational diagnosis as given from these physical characteristics.



Group 6. We often hear of "a letter in a woman's handwriting." Can you tell which of the above sample lines were written by men, and which ones by the gentler sex?

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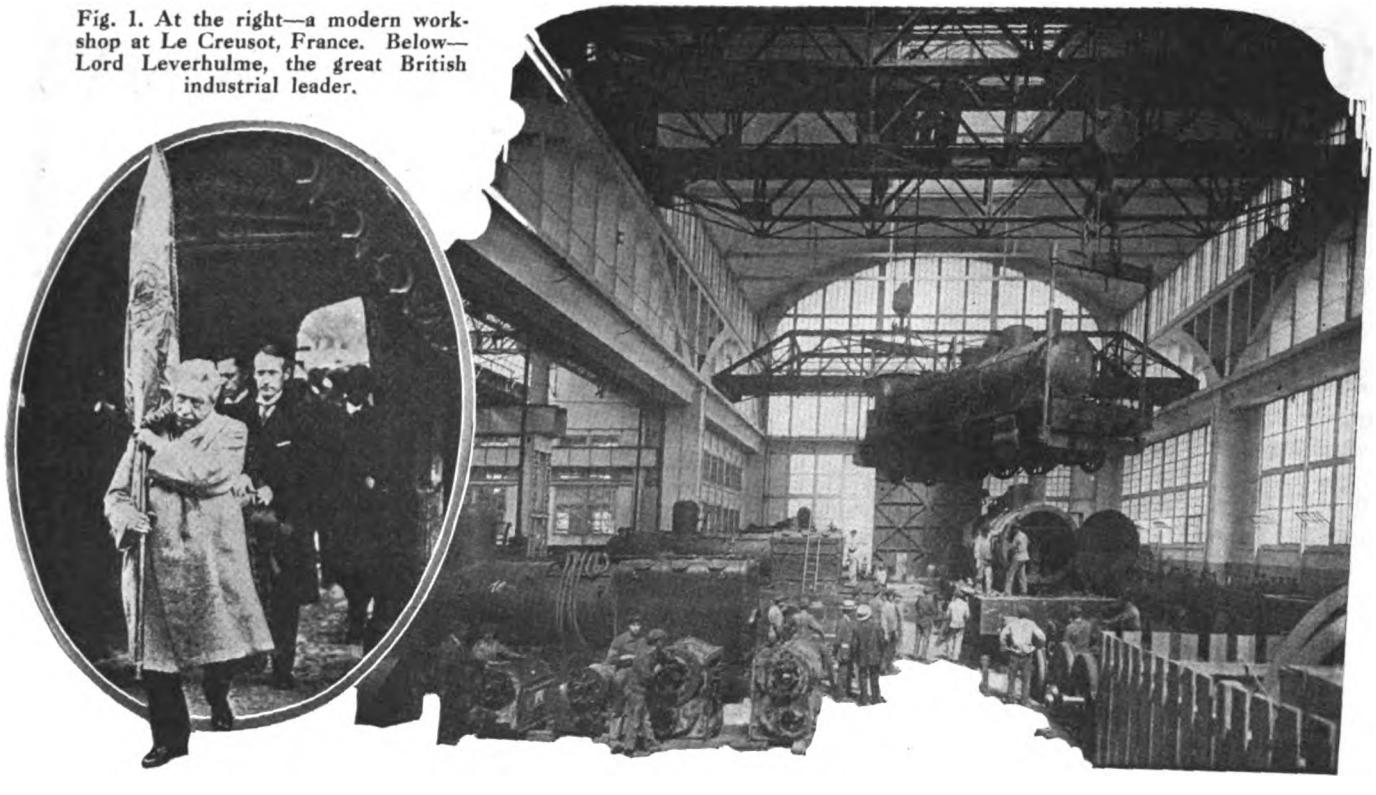


Fig. 1. At the right—a modern workshop at Le Creusot, France. Below—Lord Leverhulme, the great British industrial leader.

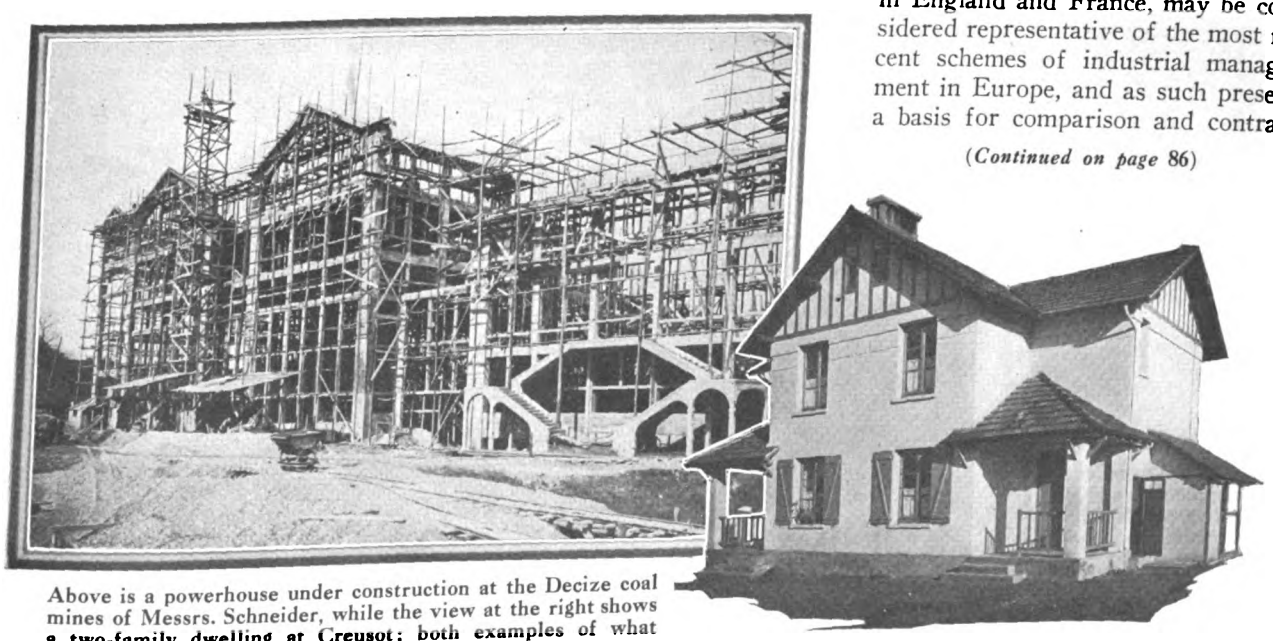
Modern Ethics in European Factories

A Review of Conditions Abroad

By Georges Benoit-Levy

IN this time of reconstruction, when industrial and commercial organization is of such importance, it may be interesting to present the views of the late George Cadbury and some of the European captains of industry to see to what extent their human ethics have reacted on their industrial prosperity. Problems and motives have been somewhat different in each case, but the following instances, selected mainly in England and France, may be considered representative of the most recent schemes of industrial management in Europe, and as such present a basis for comparison and contrast

(*Continued on page* 86)



Above is a powerhouse under construction at the Decize coal mines of Messrs. Schneider, while the view at the right shows **a two-family dwelling at Creusot; both examples of what modern industrial management is doing in France.**

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Concrete and the Modern Industrial Building

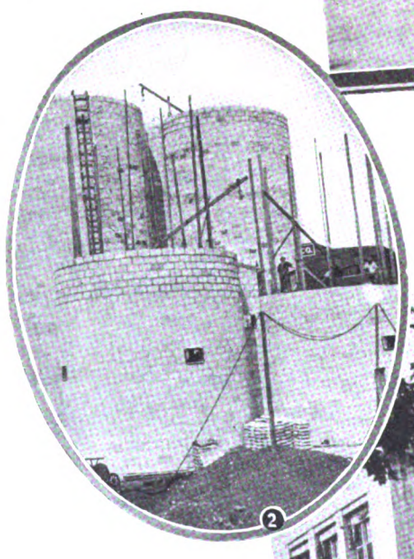
By H. Colin Campbell

AMERICA'S pre-eminent position in industry is not due to chance. Our industrial executives are the product of the school of experience. In this school they have learned that many factors influence balance sheets. Assets take on varied forms. For example, good will is often the principal capital stock of many an enterprise and its volume is such as to make its stated value in millions of dollars admittedly conservative. Every industrial executive knows that among the factors which contribute to the profits of his enterprise is proper plant quarters. Industrial buildings may be either a source of large direct profit to the enterprise or a heavy drain or menace to its resources that can wipe out its capital. For example actual tests to determine the influence of vibration of structure for certain kinds of occupancy have shown increased production because machines may be run at a higher rate of speed amounting to 15 or 20 per cent.

Financing and credits are seriously affected if an industry or business is housed in a structure that may readily be destroyed by fire. The ability of a concern to meet its obligations depends on as uninterrupted operation as possible. The fire that stops the functioning of an enterprise may not only affect its ability to meet its obligations promptly, but may make it impossible to meet them.

There are important losses resulting from fire that cannot be safeguarded against by insurance. These include losses resulting from suspension of business during which time capital investment is nonproductive. They include also the stoppage of production and loss of customers who seek other sources of supply, and frequently new business relations thus formed cannot be reclaimed. The efficient industrial organization of employees is broken up through the fact that many seek employment





Figs. 1 and 2. Two methods of using concrete for the construction of coal pockets; in the one case by poured reinforced concrete, and in the other by the use of concrete blocks.



Fig. 3. An excellent example of the decorative possibilities of concrete construction.

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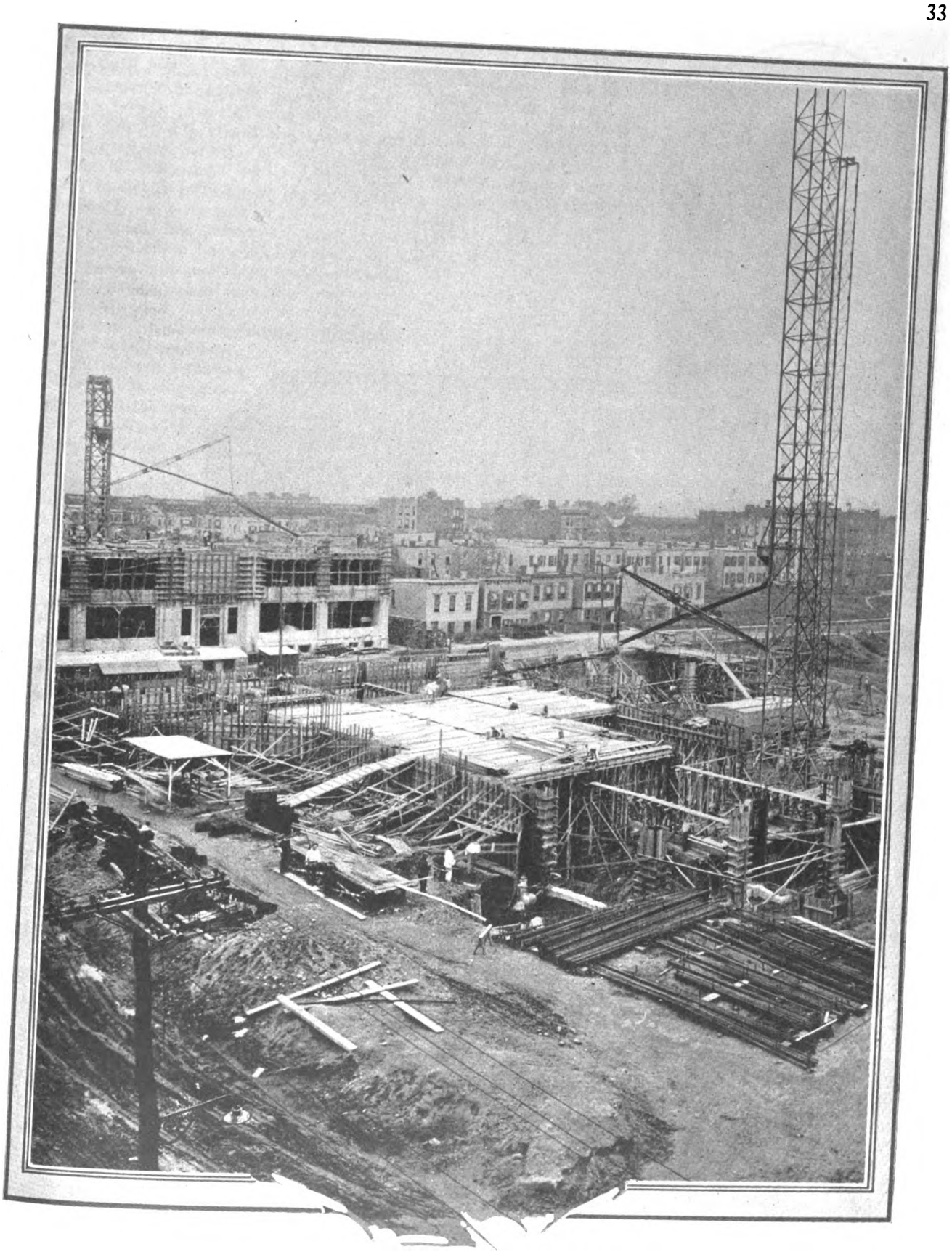


Fig. 3-A. The construction work on the Famous Players' studio, Long Island City, a structure where freedom from fire risk was of supreme importance.

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elsewhere during reconstruction and often fail to return to the original organization.

Industrial executives and their architectural and engineering advisers have been practically a unit in recent years in showing marked preference for industrial buildings designed in concrete. Those charged with choice of construction type have learned to arrive at correct comparisons between types by capitalizing such items as insurance, fire-safeness, freedom from maintenance, adaptability, speed of construction regardless of season, permanence, operating efficiency, sanitation and other qualities which may be desirable since they have recognized in these a definite money value even though unable to express in terms of dollars and cents.

Recognizing these facts, the answer to the question "what type of structure" has clearly shown that first cost is only one item and not necessarily of first importance. Ultimate economy requires the choice of that type of building on which freedom from depreciation and maintenance, low insurance and influence on efficiency of production will, by comparison with some other material, in a short time more than compensate for any probable additional first cost.

Buildings which are sanitary provide pleasant, light, well ventilated, hence healthful quarters for workers, and which assure security against personal injury from fire, tornado and earthquake, have an important influence not only on the efficiency of employees but on the reduction of labor turnover. There also follows peace of mind of



Fig. 4. Concrete is proving itself the ideal material for coal pockets. Here is another metropolitan coal yard of the type which is becoming a common sight.

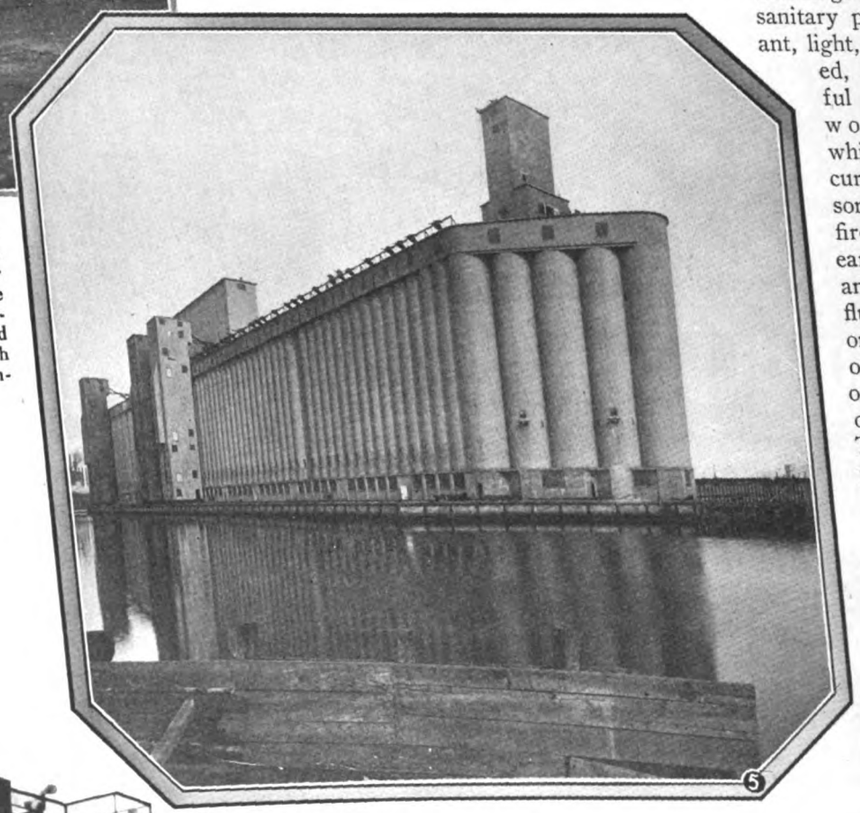


Fig. 5. This Buffalo grain elevator of over five million bushels storage capacity is the largest grain elevator in the world. In this field also concrete is proving ideal.

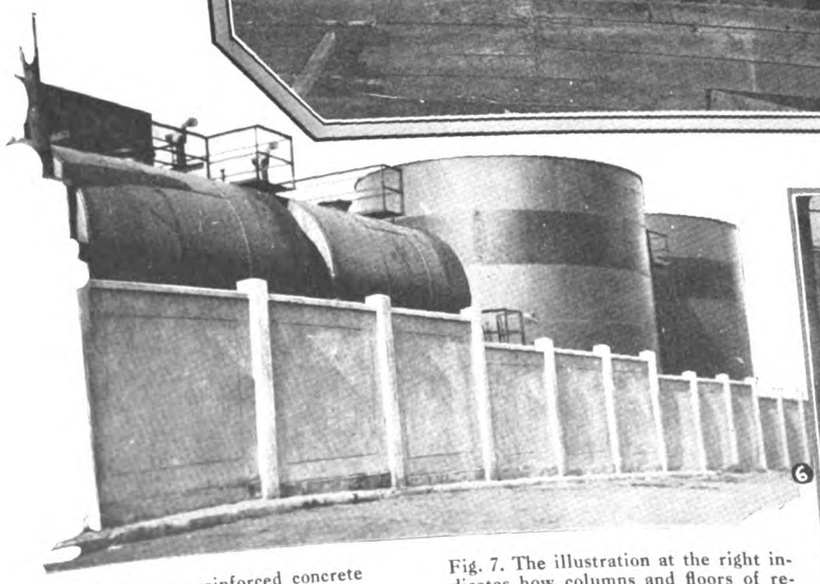


Fig. 6. Above—reinforced concrete fence surrounding the property of a large oil company.

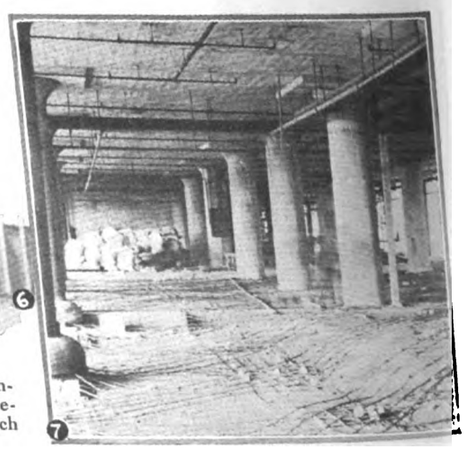


Fig. 7. The illustration at the right indicates how columns and floors of reinforced concrete tie up with each other.

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owners and operating officials in the knowledge that their business will not be wiped out by fire with the resulting loss of money and time and the scattering of patronage built up by years of endeavor. With these most desirable ends secured, there is certain to follow a beneficial effect on financing and credits. There is also a definite advertising value in the appearance of permanence and particularly fire-safeness which naturally redounds to the credit of the owners or occupants. Concrete buildings make possible the attainment of the advantages just summarized.

It is not possible to discount in advance every accident that may happen or every condition that may develop during the construction of a building. Fabrication and shipment of materials may be unavoidably delayed. Labor conditions may change so as to affect in a vital way the progress and cost of construction. Materials may unexpectedly advance in price. Many of these possible happenings may be reduced to a minimum by thorough organization and other precautions. Nevertheless the unforeseen frequently happens.

Concrete construction reduces these possible contingencies to a minimum. The structural parts of a concrete building are not fabricated in distant shops nor is their completion and de-

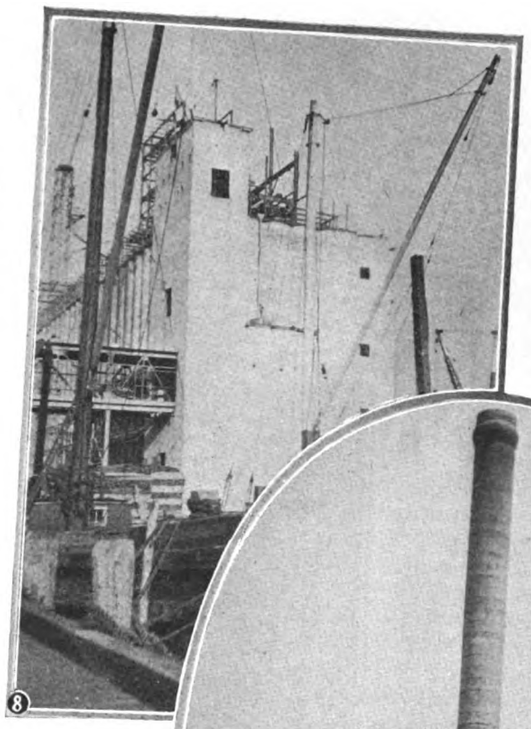


Fig. 8. At the left are the grain elevators at the Brooklyn end of the New York State barge canal, built entirely of concrete.

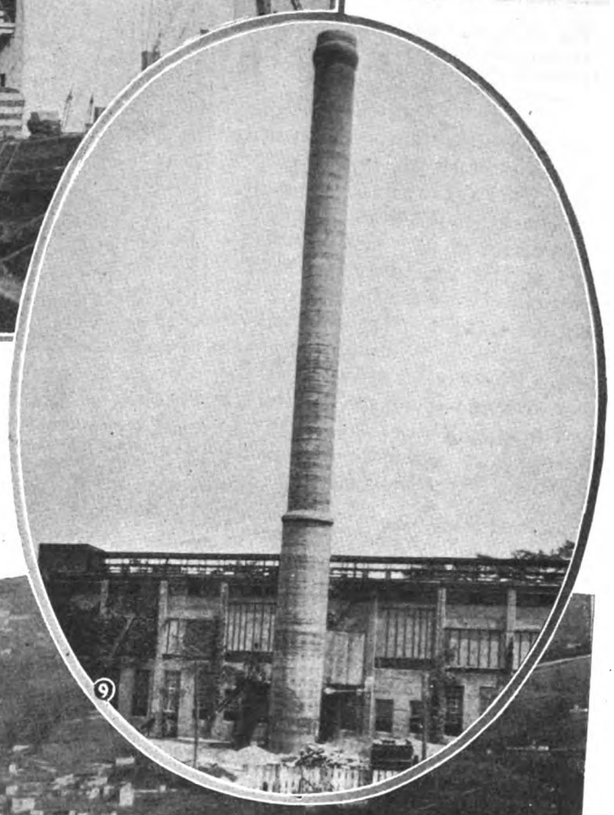


Fig. 9. Below is a 175-foot concrete stack at the power house of the Harrisburg Railway Company in Pennsylvania.



Fig. 10. The Fiat automobile factory at Turin, Italy, showing the reinforced concrete racing track on the roof.

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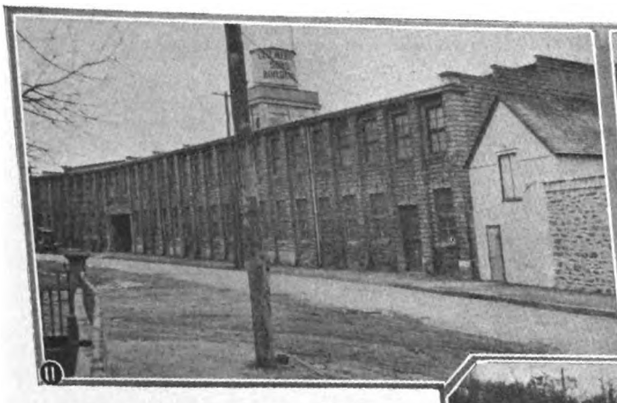


Fig. 11. An example of small shop construction by means of concrete block; a method frequently used in buildings of moderate height.

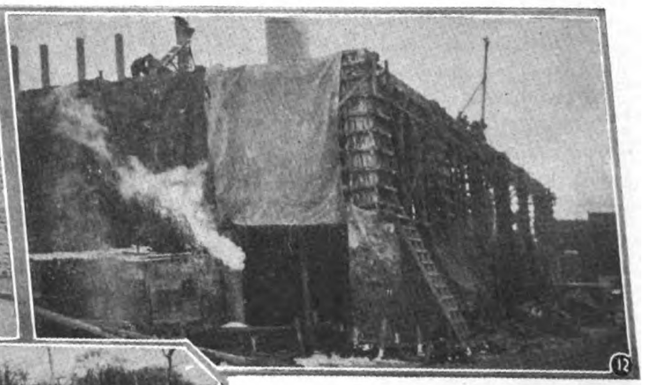


Fig. 12. With a few simple precautions, concrete construction is perfectly feasible even in cold winter weather.



Fig. 13. It might almost be said that modern foundation work, irrespective of the upper construction, is entirely dependent upon the concrete.

livery subject to transportation or to some contractor's ability. They are built in place and are under the immediate control of one contractor. Materials arrive in bulk and do not require special equipment for transportation. Motor trucks may supplement the railroad. Much of the necessary material is usually near at hand. The greater portion of the labor required is of the less highly specialized order and can usually be obtained in the vicinity of building operations. Practically all of the material may be ordered as soon as the preliminary requirements have been determined, thus removing uncertainty as to the materials market.

Concrete construction does not require the handling of heavy structural members. Equipment necessary for erection is of the simplest sort. Floors and columns are cast simultaneously, and possibility of accident is reduced to a minimum. An estimate of the first cost of a concrete building can therefore be made with a degree of accuracy not usually possible in other types of construction. The owner thus derives the benefit of a minimum charge for contingencies in the con-

(*Continued on page* 38)



Fig. 14. A large majority of modern daylight factories are of concrete construction. Above is the plant of the Norwich Woolen Mills, an excellent example of this type of structure.

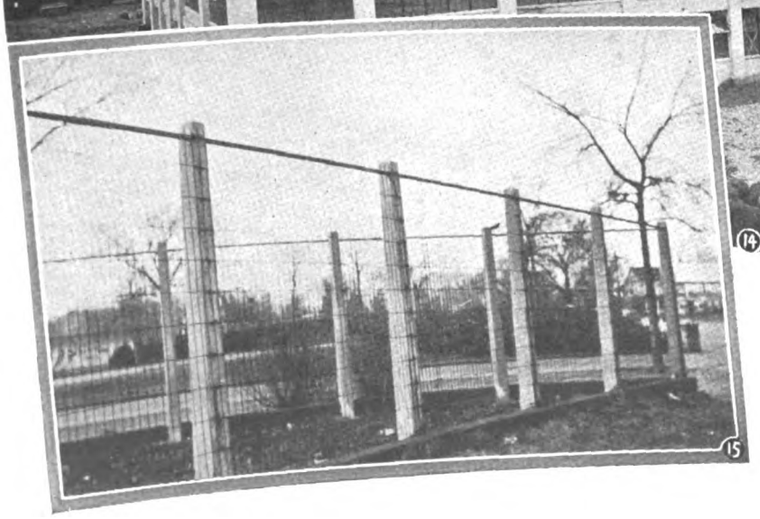


Fig. 15. Concrete fence posts are a comparatively recent but very successful development, affording strength and stability with a minimum of deterioration.

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Glare!

Now Eliminated with

SKYCO NoGlare

94% Light Intensity Maintained
Heat Lowered 10° to 15°
at Fraction of Cost of Shades

HAVE you heard how easily and economically you can eliminate glare and reduce heat with Skyco No-Glare?

Skyco No-Glare is a bluish fluid that you either spray or brush on the glass. It forms a semi transparent film that diffuses the sun's rays and absorbs the red rays. These red rays are the heat and glare rays. Thus the natural daylight is modified to an ideal, cool, restful light—the perfect light that has been striven for by much more expensive means. Glare is eliminated. And actual light measuring tests show illumination intensity of over 94% normal is maintained. Actual thermometer tests show heat is reduced 10° to 15°.

Easily Cleaned—Unaffected by Weather

You can keep glass clean that is coated with Skyco NO-Glare, too. Just wash with cold water and sponge.

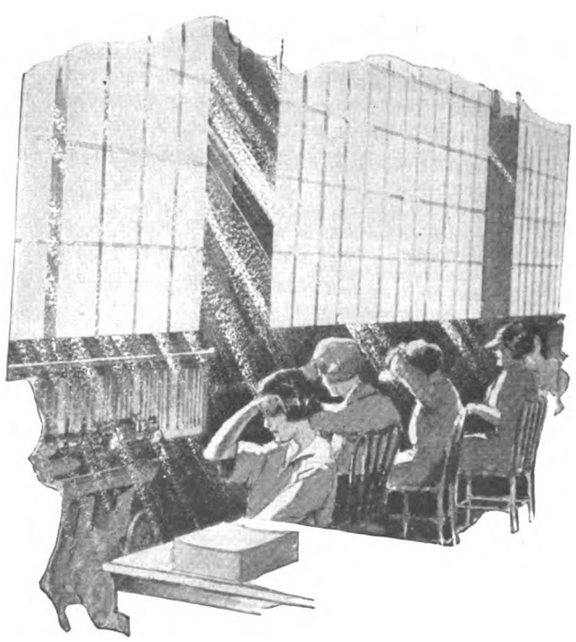
Rain or weather conditions do not affect Skyco No Glare either. Neither will it rub, or flake, off. Yet you can remove it easily with warm water and a brush.

Special Trial Offer

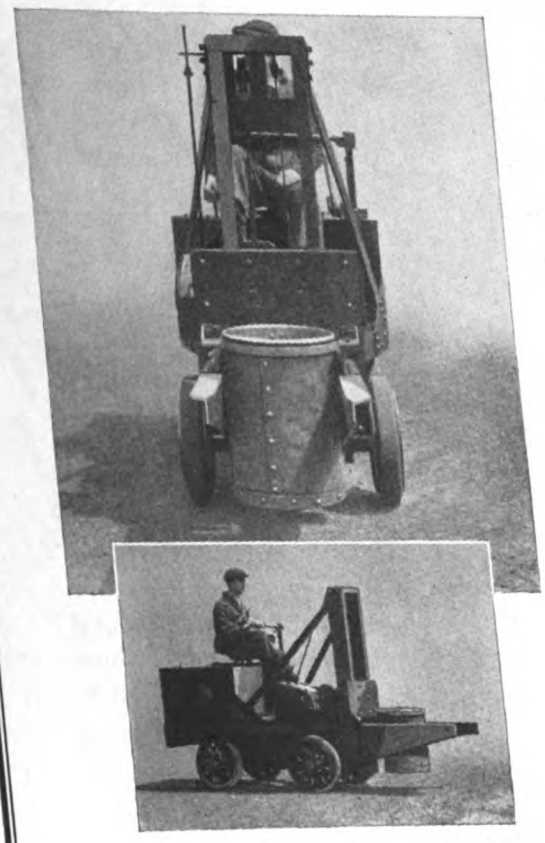
To convince you of how economically and effectively you can banish glare and reduce heat we invite you to accept this trial offer:

Order one gallon of Skyco No-Glare at $3.50 F. O. B. Cleveland. Use as much as you wish. Note how easily it is applied. Mark how it defies weather conditions. See how easy it is to remove when occasion requires. Check up how much better work goes on when glare is banished and heat lessened. Then, if you are not delighted, return the balance at our expense and we will cancel invoice.

The SKYBRYTE Company
11th Floor · Keith Bldg. · Cleveland, Ohio
***Chicago Branch:* Tower Building, 6 N. Michigan Ave.**



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Introducing Type L M
The Newest Member of the
Elwell-Parker Haulage Group

THE Elwell-Parker Type L M has one big distinguishing feature. It handles the load outside the wheel base like a crane lifting or lowering it as required. Because the operator is seated right behind the elevator he can easily "nose in" with the tructor.

It will select a single barrel, can, ladle or pot and carry or elevate it to any desired height by the simple operation of electric switches. The same procedure is possible with stacked tin or black sheets.

The high spots in the construction of Type L M are:—

Seat at front instead of pedal at rear.
Drive axle nearest load.
Short wheel base.
Standardized parts.
Hoist unit on foot board.
Automatic elevator trip.
Electric brake on elevator motor.
Battery easily accessible.
Positive, simple worm drive.

The lift adapter can be fitted to suit your work. There are no doubt several places where these tructors would prove time and money savers in your business. Request Bulletin 53.

The ELWELL-PARKER ELECTRIC COMPANY
Cleveland Ohio

Concrete and the Modern Industrial Building

(*Continued from page* 36)

tractor's bid or of low cost in a cost-plus contract. It should not be supposed that the first cost of a concrete building will be greater than that of other acceptable types of construction, in fact concrete buildings designed for heavy floor loads have been built for less than any other practicable type would have cost.

A comparison of the initial cost of fireproof buildings will almost invariably show low cost of the concrete structure.

Buildings of various types are usually placed in the following order as to first cost, beginning with the lowest in cost:

Mill construction
Concrete flat slab
Concrete beam and slab
Structural steel fireproofed.

In recent years, as everyone knows, marked changes have taken place in the materials and labor market but the net result, however, has been rather to cut down the difference in cost between mill construction and reinforced concrete instead of to increase it.

Business men now put the question—How long will it take to build?—farther to the front than ever before. Labor difficulties, shortage of transportation, desire to immediately increase production to meet an existing demand, and getting the capital invested in a building earning money at the earliest possible date have put a new value on speedy construction.

The comparative simplicity of concrete construction and the availability of necessary materials are reasons why, under equal conditions, concrete permits maximum speed of erection. An estimate of the value of high speed of construction from the standpoint of earlier occupancy, hence manufacturing operation, may easily be made. Assume a building costs $400,000, and money is worth 6 per cent. Assume also that two months may be saved in the time required to complete a building by using concrete. Not only would interest on the $400,000 be saved but there would be profit from the earlier active operation of the invested capital which would be at work two months earlier, and this is directly creditable to speed of construction. If investment in equipment and working capital to be devoted to operations in the building equals the cost of building, and the business nets 10 per cent. a year, it is worth $13,333 to get into the building two months sooner. Concrete construction may be carried on during the winter months when most other building operations are suspended or at best, advance with indifferent speed.

The total value of the fire-safe qualities of a building cannot easily be expressed in dollars and cents. It involves insurance on building and contents, the non-insurable loss always resulting from fire, influence on credits and invested capital, and the importance from the national aspect, of preventing waste of natural resources. Insurance rates differ greatly with the design, location and occupancy of buildings, yet it is true that the highest type of fire-resistive construction will carry the lowest insurance rate both on building and contents, all hazard and occupancy conditions being equal. Many

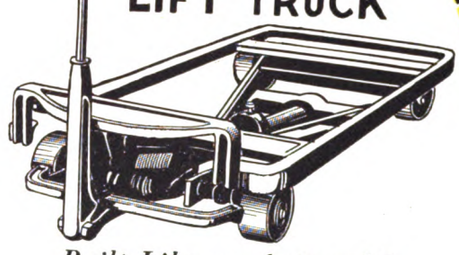
(*Continued on page* 40)

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You wouldn't buy a 3 wheel automobile truck - - - - So why should you buy a 3 wheel lift truck



The Plimpton 4-WHEEL LIFT TRUCK



STABILITY Is What You Should Have in Lift Trucks

Built Like an Automobile

Plimpton Lift Trucks (built like an automobile) cradle the load, save strain on platforms and keep the load on—no joggling or falling off or breakage.

All wheels under the load, front wheels turning at an angle of 45°, the Plimpton operates in the narrowest of aisles allowing for the most efficient use of floor space.

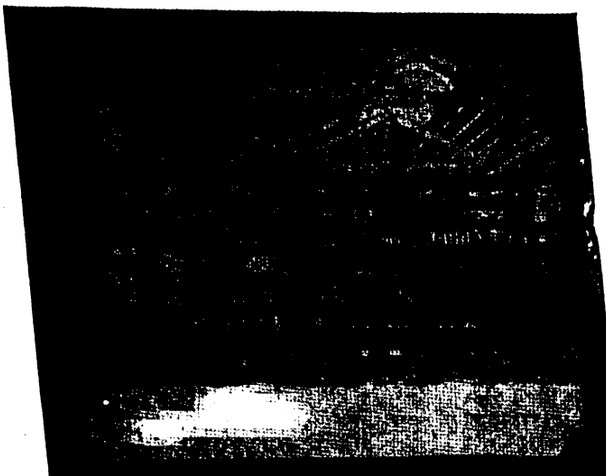
With its four aligning wheels, its 4 point load suspension and right angle steering knuckles, the Plimpton solves the question of lift truck stability. Two front wheels mounted on a swiveling axle and turning under like carriage wheels are no better than one, when it comes to a right angle turn. Stability is most needed when turning corners.

Write for **"Facts"** giving in detail the many points of Plimpton superiority. Plimpton's have been sold for ten years to biggest executives throughout the world. An investigation of Plimpton Efficiency always results in their installation.

The Plimpton
LIFT TRUCK CORPORATION
Stamford Conn. U.S.A.

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MEDART
Steel Shelving
for FACTORIES, WAREHOUSES STOCKROOMS, TOOL ROOMS

MEDART STEEL SHELVING consists of just a few standardized, interchangeable parts. Easily and quickly assembled or rearranged to meet changing requirements. Takes up less space than wood, is stronger, neater, more durable, and is fire-proof. The cost is surprisingly low. Write for catalog "S-7."



MEDART
Steel Lockers

Medart Steel Lockers are furnished in all types and sizes to meet any need or arrangement. Write for catalog "A-13"

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Potomac and DeKalb Sts., St. Louis, Mo.
New York, 511 West 27th Street Chicago, 326 W. Madison St.
San Francisco, Rialto Bldg.

(*Continued from page* 38)

owners of concrete buildings carry no insurance on their structures. Some insurance companies allow approximately 40 per cent. credit for concrete, and in general, insurance on a concrete building will be from 30 to 60 per cent. less than on a mill constructed building, depending on occupancy. Take for example a piano manufacturing plant on which the occupancy hazard may be considered high, the plant located in a city with fire protection, not exposed to other buildings and equipped with sprinkler system. Insurance on such a plant of mill construction will be about 28 cents per $100, while on a reinforced concrete building it will be about 10 cents per $100, or a difference of 18 cents per $100 in favor of concrete. A further credit is to be given the concrete building because of lower insurance on its contents, and in the above example the difference in insurance on contents will amount to about 23 cents per $100 in favor of the concrete structure. Assuming the value of contents as twice the value of the building, a saving of 23 cents per $100 value of contents would amount to 46 cents per $100 on the initial cost of the building. Capitalized at 6 per cent., these credits for insurance amount to $10.60 or approximately 10⅔ per cent. on the first cost, which should be credited to the cost of the concrete building. In other words, the advantage in insurance rates on both building and contents allowed because of reinforced concrete construction would in this case justify an expenditure amounting to over 10 per cent. more than the cost of mill construction.

Any industrial executive can apply the principles in the case above assumed to his own proposed building problem, to determine the actual savings that will result from fireproof construction. Knowing in general the nature and value of the occupancy of the structure, he can obtain from insurance companies a fairly accurate estimate of the actual rates that will be charged on a concrete building and on one of non-fireproof construction, and their contents. The difference capitalized at the current rate of interest will represent the actual saving in insurance from a concrete building. Insurance is usually written on only a portion of the value of the property insured. The remainder of the risk must be assumed by the owner. Ordinarily he is required to be a co-insurer to the extent of about 20 per cent. of the value of the property. For a concrete building this is a very small item and if the building has a non-combustible occupancy, no insurance need be carried on the building; in fact, the rates quoted for such risks when offered are so low as to represent merely the overhead expense of writing the insurance. Provision should, however, always be made for the co-insurance portion of all combustible mercantile or industrial buildings. In any fire, the greater the loss, the greater will be this uninsurable loss to the owner.

In a concrete building the concrete floors and walls confine the fire to the location of origin and reduce to a minimum the fire hazard. Moreover, concrete floors being waterproof, protect the contents of lower floors from damage due to water from sprinklers and fire hose.

Insurance covers only a part of the hazard and may be sufficient only to meet the obligations of the concern, the remainder representing the owner's personal loss. In many cases a severe fire in which the loss is practi-

(*Continued on page* 42)

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The Corner is the Strongest Part

STRENGTH, rigidity, and low maintenance expense — these are the factors you want and what everyone expects in Platforms and Boxes.

There is no wobble to Truscon Steel Platforms—in fact you cannot overload them. The secret of their extraordinary strength and rigidity, is in the construction of the corner, where the depth of the reinforcing rib is actually deepest. This depth, together with the special formation produced by bending, results in a double reinforcement, which makes the corner the strongest part of Truscon Platforms.

The same rigid-rib construction used in Truscon Steel Platforms is the feature which makes Truscon Alloy Steel Boxes stand up under unbelievable rough handling and abuse.

Truscon Alloy Steel Platforms and Boxes, used together, give you an unsurpassed combination for cutting down non-productive handling and rehandling expense. Not only is the maintenance of Truscon Steel Platforms negligible, but accidents due to collapsing from overloading, are unheard of because of their integral construction.

Send for our book on Handling and Conveying—just off the press.

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ALLOY STEEL
PLATFORMS AND BOXES

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO

Special representatives for Steel Boxes and Platforms in New York, Philadelphia, Chicago, Pittsburgh, Cleveland, Buffalo, Detroit, Boston, St. Louis, Cincinnati.

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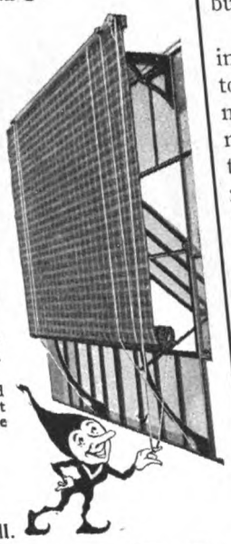
—RA-TOX Shades for Steel Sash—
Light and Air—
—Without the Glare

Light without heat and glare, and fresh air without draughts will increase the efficiency of your employees and add materially to your profits this year.

Secure these benefits for yourself and everyone in your employ now—equip with Ratox Shades. Suspended from enameled steel brackets which are secured directly to the steel sash, they are guided around the center swing ventilator and brought back flush to the wall, at the base, out of the way of machinery or workers—*independent action of center swing ventilator and shade.*

With average care they will serve 20 years or longer. Built of stained bass-wood strips woven parallel with hard twist seine twine.

Send specifications for price quotation and descriptive literature. Write now, before hot weather sets in. Please address correspondence to estimating department.



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RA-TOX
OFFSET WOOD FABRIC SHADES FOR STEEL SASH



The Prest-O-Lite Co., Indianapolis, Ind.

FOR IMMEDIATE SERVICE

A Choice of over a thousand different sizes and types of standard structural steel buildings, each COMPLETE, PERMANENT and FIREPROOF, awaits your selection with

Milliken Buildings

These buildings are known generally for their marked efficiency and economy, giving the owner a specially designed structure, without delay, at the cost of an ordinary building.

They are suitable for many branches of industrial service, such as shops, warehouses, power houses, light manufacturing plants, etc., and can be erected singly or in groups. The material is ready to ship on short notice, and all construction can be carried out with local labor.

We have issued a distinctive semi-technical catalog on standardized steel buildings of MILLIKEN type, illustrated and complete—even to prices. A copy is free for the asking.

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Established 1857

Transmission Towers *Radio Towers*
MILLIKEN BUILDINGS

(*Continued from page 40*)

cally total, marks the death of the enterprise. Total loss cannot occur if the industry is housed in a concrete building.

Maintenance of a structure includes cleaning, painting and such repairs and replacements as are necessary to keep the structure in a condition fit for use. Maintenance of those parts of a structure which can be replaced may be carried on indefinitely but the most vital structural parts of buildings do not admit of easy replacement, nor can all of such parts be reached with preservative treatments or coatings tending to preserve their useful life. It is therefore impracticable to maintain indefinitely, structures whose vital parts are subject to rust or rot.

Maintenance on a depreciable building grows greater from year to year, as do depreciation charges. With depreciation also comes a gradual, perhaps unobtrusive, but none the less real reduction in efficiency of operation.

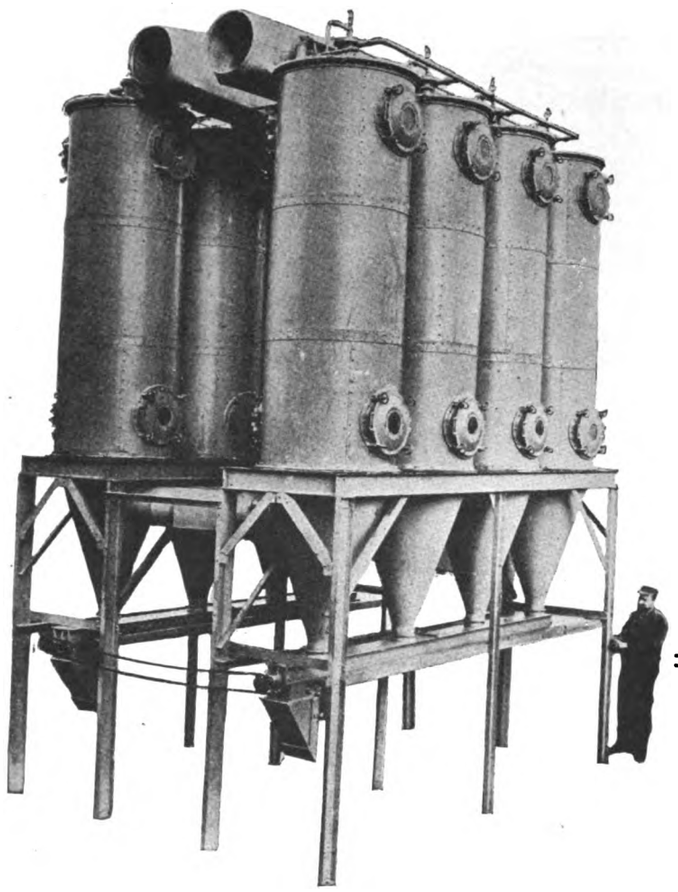
In comparing the economy of various types of buildings, maintenance may be taken as an average of 1 per cent. per year, of the cost of the building. This $1 per 100, capitalized at 6 per cent., shows that over $16 more per $100 original cost could be spent for the maintenance-free concrete building than for one of depreciable type. Yearly maintenance, however, is to be distinguished from gradual depreciation which, after a term of years, renders the structure unusable regardless of the maintenance done on it. In order to provide for financing the new building necessary at the end of a given term, a sinking fund must be set aside annually so that at the end of the building's usable life there will be an amount available equal to the initial cost of the building. Concrete buildings require no such sinking fund for their structural portions because their life is not limited by a decrease in strength through gradual depreciation.

Obsolescence may be described as the total loss of value for any useful purpose of a structure because of altered environment or because of conditions affecting manufacturing processes and desirability of location. Residence districts sometimes change to business districts. Industry in turn follows certain trends of city growth and development so that portions of a previous retail district may become a wholesale or warehouse district. In the course of time, the wholesale district becomes a loft or light manufacturing district or warehouse district. Warehouse locations may become undesirable by the opening up and development of new lines and means of transportation and discontinuance of the old. The development of new machinery for manufacturing processes may be such as to render buildings unfit for the operations for which they were originally designed and if the building cannot be adapted to some use under the new conditions, it is obsolete. Therefore a correct allowance for obsolescence requires a correct estimation of future conditions, together with the selection of a type of building that will best meet those conditions.

As concrete buildings are now designed, they have great reserve strength; that is, the unit stresses used in designing them are very much below the stresses to which concrete may be safely subjected, and since their strength increases with age, concrete buildings designed for mercantile purposes are likely to have the reserve strength necessary for other occupancies. In fact, a building possessing the required strength and freedom from

(*Continued on page 44*)

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DRACCO Perfecto Filters

Protect Your Property and the Health of Employes

Recovers all solids from gases of smelters, blast furnaces. Solves all dry dust collecting problems.

Dust is a dangerous explosive. Disasters have continually occurred in modern and supposedly fireproof plants. Many workers have been killed and the property loss has amounted to millions of dollars.

It is paramount that your plant be kept clean at all times; and that the air your employes are obliged to breathe be free from contamination.

The Dracco Perfecto dust recovery installation is the latest and best development of the pneumatic principle in dust collecting equipment. It solves the problem of handling fine, coarse, sticky or granular materials and will clean air or gases more efficiently than any other equipment.

Let us explain to you how Dracco can protect *your* property and safeguard the health of your workers.

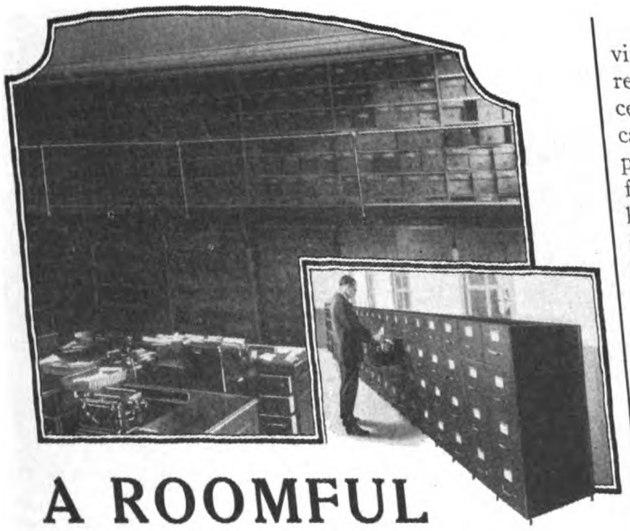
They recover solids from air or gas at a minimum cost, and within minimum space requirements.

DRACCO DOES IT

THE DUST RECOVERING & CONVEYING CO.

Engineers and Manufacturers, Cleveland, Ohio.

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A ROOMFUL OF DOCUMENTS

Re-Filed in Van Dorn Transfer Cases

A CERTAIN prominent railroad office filed documents in boxes as shown in the upper picture. The system was fairly satisfactory, too. No one was urging a change.

But Van Dorn showed how the whole roomful of papers could be compactly filed as shown in the lower picture! Results: (1) Much room saved by tearing out old shelving; 2) Light of four windows made available; (3) Climbing ladder to balcony eliminated; (4) Neater appearance; (5) All files more quickly found.

The point is that, while *your* problem may be entirely different, Van Dorn can solve it too!

THE VAN DORN IRON WORKS COMPANY, Cleveland

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Van Dorn
MASTERCRAFTSMANSHIP IN STEEL

(*Continued from page 42*)

vital depreciation may run the entire gamut of occupancy required by changing environment or manufacturing processes and thus escape death by obsolescence. Many cases are known of concrete buildings having been occupied by one after another of different industries ranging from mercantile to light manufacturing and loft to warehouse. These changing occupancies have often afforded interesting sidelights on the great strength of concrete buildings, as in the case of the Kindell Bed Co. building, Long Island City, New York. This was originally designed for 200 pounds floor load. Through changes of occupancy it became a warehouse for the storage of sheet tin, resulting in floor loads as great as six times those for which the floors were designed.

Any well built concrete structure may be used for light manufacturing purposes or for housing rapidly moving machinery. Non-inflammable occupancy may change to inflammable occupancy, a mercantile building to a warehouse, a warehouse to a manufacturing plant and vice-versa.

Adaptability or suitability concerns those qualities inherent to or easily secured in a type of construction which makes a building best suited to the particular occupancy proposed. While it is scarcely practicable to measure exactly the value of adaptability in dollars and cents, nevertheless some of the various qualities that go to make up adaptability are of great importance. It is manifest that buildings in which people work should be sanitary. Sickness, poor health and low vitality of employees affect in a vital way their efficiency and therefore the efficiency of the business or industry. The very nature of concrete buildings affords utmost sanitation.

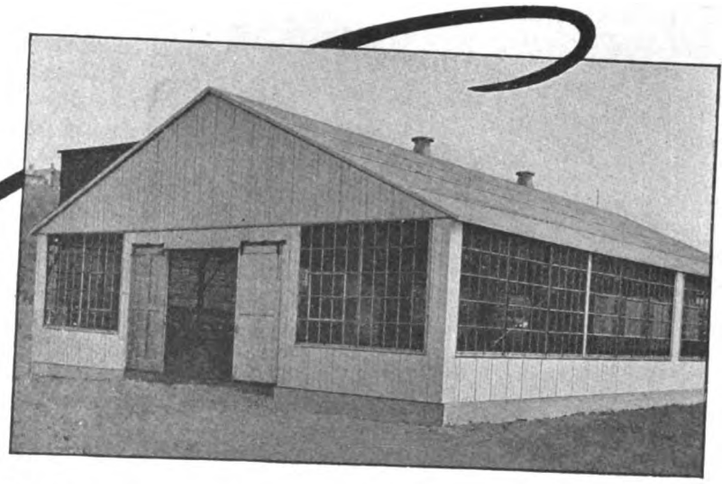
Sunlight is necessary to the preservation of ideal sanitary conditions. Ample natural light is also necessary to highest efficiency of operation—in fact it is vital to all manufacturing processes. As concrete buildings allow maximum lighting area, they meet these requirements and at the same time effect economy from the utilization of wall space for glazing, which costs less than solid wall construction. For all classes of buildings, natural light is an asset which will effect a saving in the cost of artificial lighting as well as add to the efficiency of operation and lower the cost of construction.

Industrial buildings, though primarily designed along utilitarian lines, may be given simple architectural treatment at a very small expense. Ornament is easily added in the form of concrete cornices or balustrades. Proper attention given to the selection of aggregates leading to special surface finish will result in pleasing effects. Stucco in considerable range of color may be used as a surface finish.

An exceptional degree of security from destruction of buildings and loss of life from tornado, earthquake and explosions is provided by the rigidity of concrete. The San Francisco earthquake and fire, the Baltimore fire, the munition shop explosion in Halifax Harbor, the Fergus Falls, Minn., tornado, earthquakes in San Domingo, Guatemala and Japan, and numerous other examples testify to the great resistance of concrete buildings against destruction or serious damage. Life and property are truly conserved by such structures and their occupants have the assurance at all times that they enjoy the highest measure of protection against the destructive forces of nature.

(*Continued on page 46*)

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SPEED at LOW COST

and Convenience in Financing

SPEED costs you nothing when you build with Blaw-Knox Better Buildings.

The standard pre-fabricated units, shipped from stock, are quickly in place. In a remarkably short time your building is in use.

First cost is low. Shop production, in quantity, makes possible many economies.

Yet long service is assured.

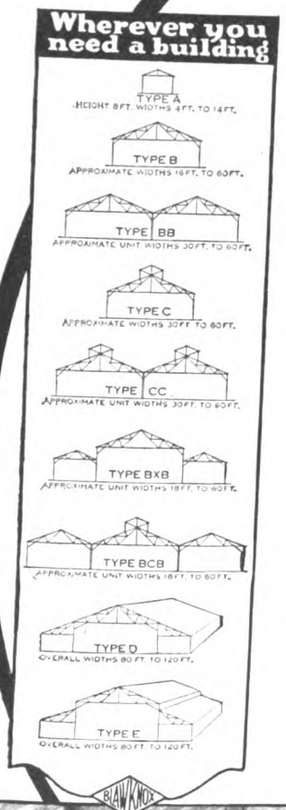
The steel is protected by a heavy coating of zinc. Not even a bolt hole mars this protective surface. Rust cannot gain a foothold.

Only in Blaw-Knox Better Buildings do you find this double protection.

Leak-proof skylights in the roof are another exclusive advantage offered by Blaw-Knox alone.

Storage buildings thus may have walls of steel, with no windows to encourage prowlers. Small shops may have light thru the roof in addition to that afforded by steel sash.

Hundreds of companies, some owning as many as seventeen Blaw-Knox Better Buildings, verify your wisdom in selecting these standard structures.



You Should Read These Booklets

"The General Manager Solves The Building Problem" outlines the practical application of Blaw-Knox Better Buildings. "The Blaw-Knox Building Finance Plan" clearly illustrates the "pay as you earn" service for large or small buildings. Read these books before you build. Let us send you prices and plans.

Pay As You Earn

Your low first cost may be spread over a convenient period. Blaw-Knox alone offers this "pay as you earn" service. You know the advantages of this convenience—how it solves the building problem without straining credit and hampering business. Ask for the details of our Building Finance Plan.

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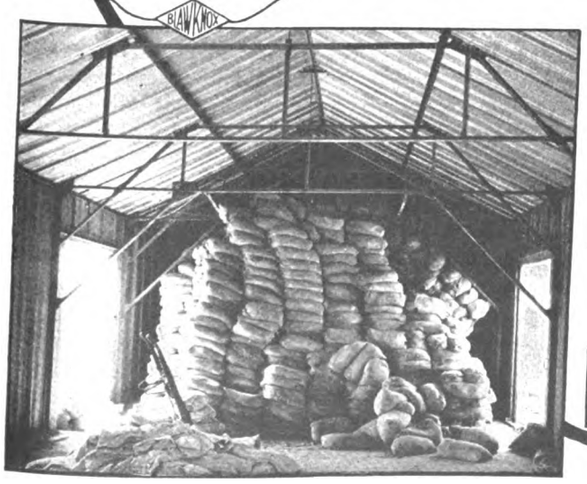
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Maehler *Multiple-Pass Conveyor Ovens, designed for quantity production of small parts with low labor, power and fuel costs.**

The loading and unloading requires but two girl operators. This conveyor automatically dips and bakes 1400 lbs. of castings per hour, 27,000 pieces per eight-hour day at a fuel cost of $2.00.

The results are typical of our cost reduction methods.

A Maehler *Multiple Pass** Oven fitted to your product will result in an immediate and decided operating cost saving. We will be glad to advise you.

These ovens are mechanically perfect, of high grade workmanship, and give uninterrupted service.

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Maintain Your Floors Without Interrupting Production

Quickfix

48 Hour Concrete Floor Patcher

QUICKFIX makes a concrete patch of flint-like hardness, ready for traffic in only 48 hours. Ordinary concrete patches block traffic and delay production for ten to twenty days while they harden. With QUICKFIX *you can patch the floor Saturday and open it up to traffic Monday.* Any handy man can use it. No costly delays or interference with plant's operation.

Patch those holes *now*—before they get larger. Don't run the risks of injuring workmen, damaging valuable materials, and slowing up production. Use QUICKFIX and eliminate the danger spots quickly. Send for our QUICKFIX BOOKLET with full details. Show your organization what efficient maintenance means.

SANISEAL—*Gives any dusting, crumbling concrete floor, old or new, a wear-proof, dust-proof surface.* Get our SANISEAL BOOKLET. SANISEAL *without* SHUTDOWN.

The Master Builders Company
CLEVELAND, OHIO
Factories: Cleveland & Irvington
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THE MASTER BUILDERS COMPANY
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Gentlemen: Send us complete information about:
Quickfix--for making permanent wear-proof concrete patches in 48 hours. We have _____ Sq. Ft. to repair.
Saniseal -- to harden dusting concrete surfaces.
Name _____
Address _____

Maintain Your Floors Without Interrupting Production

(*Continued from page* 44)

Buildings whose occupancy requires the use of rapid moving or reciprocating machinery deserve special consideration as to structural material. Machinery once anchored, adjusted and aligned in a concrete building will stay put. Alignment of shafting and adjustment of machines is held correct and the service as well as efficiency of machinery is increased thereby. Experiments have established the fact that printing presses may be run 20 per cent. faster and shoe manufacturing machinery, 15 per cent. faster in vibrationless buildings than in those not free from vibration. Designing engineers who specialize in textile mills have chosen reinforced concrete as the superior type because of its freedom from vibration and maintenance.

As the yearly turnover or total value of business in an industrial building often amounts to several times its first cost, an increase in production of as much as 15 or 20 per cent. may equal a very large portion of the total first cost of the structure.

Warmth and dryness are qualities generally desirable in all buildings. These may easily be obtained in a concrete building. In general, warmth and dryness depend on insulation, that is, upon the effectiveness of retarding the passage of heat. Concrete, even without the aid of insulating materials, is a poor conductor of heat and when used either with insulating membranes or by providing dead air spaces, possesses ideal insulating qualities. Both of these methods of securing insulation are easily carried out with concrete. The usual inside finish of furring lath and plaster furnishes the necessary insulation to prevent condensation of moisture on the walls and adds its resistance to the passage of heat to the resistance furnished by the concrete walls themselves. No moisture passes through dense, well built concrete. Because of these qualities, concrete buildings are easily kept warm in cold weather and comfortably cool in warm weather.

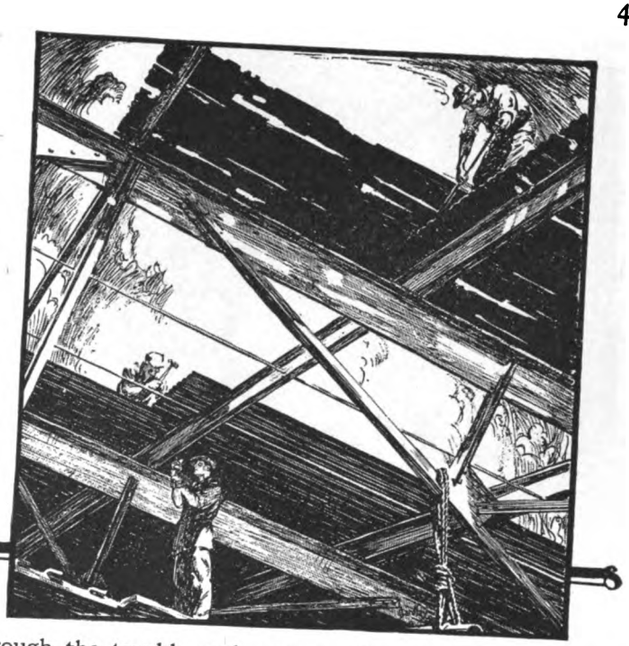
Buildings designed to house industries requiring special machinery should be planned to obtain the most efficient production and utilization of space. The general occupancy is usually known beforehand and the arrangement of machinery, location of elevators, shipping, receiving and other handling facilities can be well worked out and provided for in the design, which should also provide for anchoring machines, supporting shafting and similar details. In those cases where the occupancy is not fully known or where it is desired to provide for change in occupancy, insets and grooved channels can be placed at suitable intervals to anticipate for a variety of machinery arrangement. If for unavoidable reasons, changes or alterations in concrete buildings are necessary, they can be made with surprising facility when undertaken by experienced workmen with suitable tools and appliances.

Actual savings resulting from a concrete building when compared with one of less firesafe materials have been pointed out. It has been found that the capitalized saving on insurance and maintenance on a concrete building as against one of combustible, depreciable nature may be as high as 25 per cent. Whatever difference there may be between first cost of a fireproof reinforced concrete building and one of combustible type is certain to be returned to the owner in a brief period of years through these savings, after which they are all gain. The unavoidable depreciation of a building for perishable mate-

(*Continued on page* 48)

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Why Go Through This Every Few Years?





Here is a "cut-away" view of Robertson Process Asbestos Protected Metal Sheeting. It shows how one impervious coating is laid over another in the process of protecting the steel core from weather exposure and all other corrosive influences.

Why go through the trouble and expense of repairing or replacing worn-out roofing and siding every few years? This year replace your deteriorated building coverings with a *permanent* material. Do it with Robertson Process Asbestos Protected Metal (APM). Then you will be done with costly repairs, painting and replacements for years to come.

Put your replacement problem up to Robertson Engineers. Without obligating you in any way, they will make a careful survey of your requirements and submit recommendations and estimates covering the *permanent replacement* of your perishable roofing and siding with Asbestos Protected Metal.

APM is a permanent building material in every respect. It is a steel roofing and siding sheet made rust, weather and corrosion proof by three impervious protective coatings (1) Asphalt, (2) Asbestos Felt and (3) Waterproofing. It will deliver years of service under the most adverse conditions without requiring painting or repairs. It successfully resists the destructive action of smoke, steam, fumes, gases—all the corrosive influences that shorten the life and usefulness of less durable materials. **And the cost of APM is less than that of any other material of equal permanence.**

Perhaps you need a complete new building—a permanent building—yet one that can be erected quickly and economically. Robertson Engineering Service and Robertson Building Products are ideally adapted to the roofing and siding requirements of a structure of this kind. Let us give you complete information. The coupon is for your convenience.

H. H. ROBERTSON COMPANY, Pittsburgh, Pa.

Factories: Ambridge, Pa.; Sarnia, Ont., and Ellesmere Port, Cheshire, England.
Branch Offices: In all principal cities in the United States.
For England: 110 Fenchurch Street, London E. C. 3. *For Canada:* H. H. Robertson Co., Limited, Sarnia. General Sales Agents for Canada and Newfoundland: B. & S. H. Thompson & Co., Limited, Montreal, Toronto, Winnipeg, New Glasgow, N. S. and Vancouver, B. C.

Some Prominent Users of APM

	First order	
Bethlehem Steel Corp.	1910	80 orders
Davison Chemical Co.	1908	76 orders
General Chemical Co.	1909	133 orders
Hudson Coal Co.	1918	65 orders
Pennsylvania R. R. System	1909	120 orders
Standard Oil Co and Subsidiaries	1912	155 orders
United States Steel Corp.	1909	318 orders

Asbestos Protected Metal *for* ROOFS *and* SIDING

Architects, engineers and plant owners will find interesting and valuable information in our advertisements in Sweet's Architectural and Sweet's Engineering Catalogs.

ROBERTSON PROCESS METAL PRODUCTS

H. H. ROBERTSON CO.
Pittsburgh, Pa.

I would like complete information regarding the **PERMANENT REPLACEMENT** of worn-out roofing and siding with Asbestos Protected Metal.

I am planning the construction of a new..... building. I would like to know the cost and advantages of covering this building with APM.

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City .....

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(*Continued from page 46*)

rials in its structural parts must be provided for by a sinking fund which at the end of the useful life of the building will be sufficient to replace it in kind. Obsolescence may require the removal of a building or a change in its occupancy before the end of its natural life. The great strength of concrete buildings fits them for changes in occupancy or even removal to some other desired location, so depreciation through obsolescence need not be charged against them. Also, change of conditions must be extreme to compel the demolishing of a building that may have its occupancy changed or be moved to defeat obsolescence. In such cases the increase in value of the ground space will more than compensate for the loss. It appears therefore that sound financing requires a sinking fund charge on non-permanent, depreciable buildings and none on a permanent, non-depreciable one. This procedure may be said to be without exception for many locations of industrial buildings because of natural surroundings or of zoning laws fixing the location of industrial enterprises.

Summing up the economic features discussed, we find that:

1. Savings from insurance and maintenance alone are sufficient to warrant an expenditure of one-third more for a non-depreciable, permanent concrete building than a depreciable one would cost.

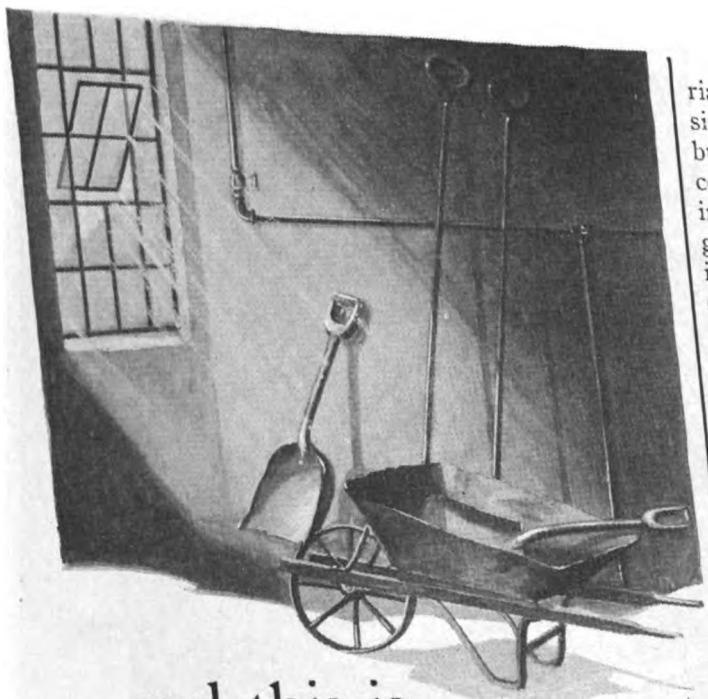
2. Concrete buildings suffer no depreciation in their structural parts. They escape obsolescence through adaptability to change of occupancy and their fitness to be moved, and no sinking fund need be provided for them. From 10 to 15 per cent. more may be spent for such a building than for one whose service life is limited. Depreciation requires a sinking fund sufficient to equal the original cost of the building at the end of its service life, which must be provided for non-permanent, depreciable buildings.

3. Efficiency of operation in vibrationless, well lighted, sanitary, comfortable, concrete buildings is certain to yield a considerable annual return on the first cost of the building, often higher than 6 per cent. Strictly speaking, this would mean that double the amount might economically be spent for such a structure.

4. Concrete's first cost is reasonable, less financial hazard is involved in construction, and a direct saving results from speed of construction and earlier occupancy.

The ultimate economy of the highest type of industrial building—reinforced concrete—will be shown in any reasonable comparison.

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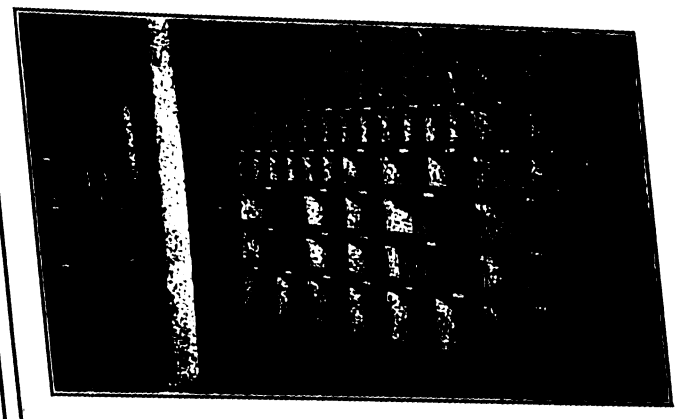


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Efficient Store Rooms

By Ernest Cordeal

THERE is no better place to start a campaign for improved factory efficiency than in the store room. The manner in which the stock is kept and the system with which its movement is followed have a great deal to do with the efficacy of any production system which may be introduced.

The first essential of an adequate store room is sufficient space and convenient arrangement. The factory manager who crowds his store room off into some small, dark, inaccessible corner is making a grave mistake which he will pay for many times over in constant delays and errors in the delivery of material and in unexplainable accumulations of dead stock. In a factory of any size the quantity and weight of materials which daily move in and out of the store rooms is considerable and an arrangement which permits the parts to be delivered to and from the shelves and bins directly from trucks or floor boxes will usually save in handling labor alone more than the floor rent of the additional space required over a crowded department where materials must be slowly and laboriously handled by hand.

Good lighting is another important factor of the well appointed store room. When it is possible for the stock keeper to see pattern and part numbers in any part of the room much time will be saved in filling orders and many costly errors will be avoided.

Planning the bin arrangement for the store room is a task for the plant engineer in conjunction with the production manager. The bins should be of the proper size and shape to hold the maximum necessary supply of the parts for which they are intended as indicated by the manager's schedule of production. Obviously the large and heavy parts should be given space toward the bottom and the lighter, smaller parts at the top of the bin sections. It is usually more convenient and certainly makes a better appearance to build the sections wide at the bottom and narrower at the top. Very deep bins for small parts, which are present when the sections are straight up and down, makes them very inconvenient to handle rapidly.

The weakest point in most small and new factories is in the proper handling of and accounting for materials. Many companies new in the manufacturing game have gone bankrupt primarily for the lack of system and order in the matters of purchasing and taking care of their materials of production at a time when, in most instances, sales can no more than cover unavoidable expense.



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and 11 Other Materials

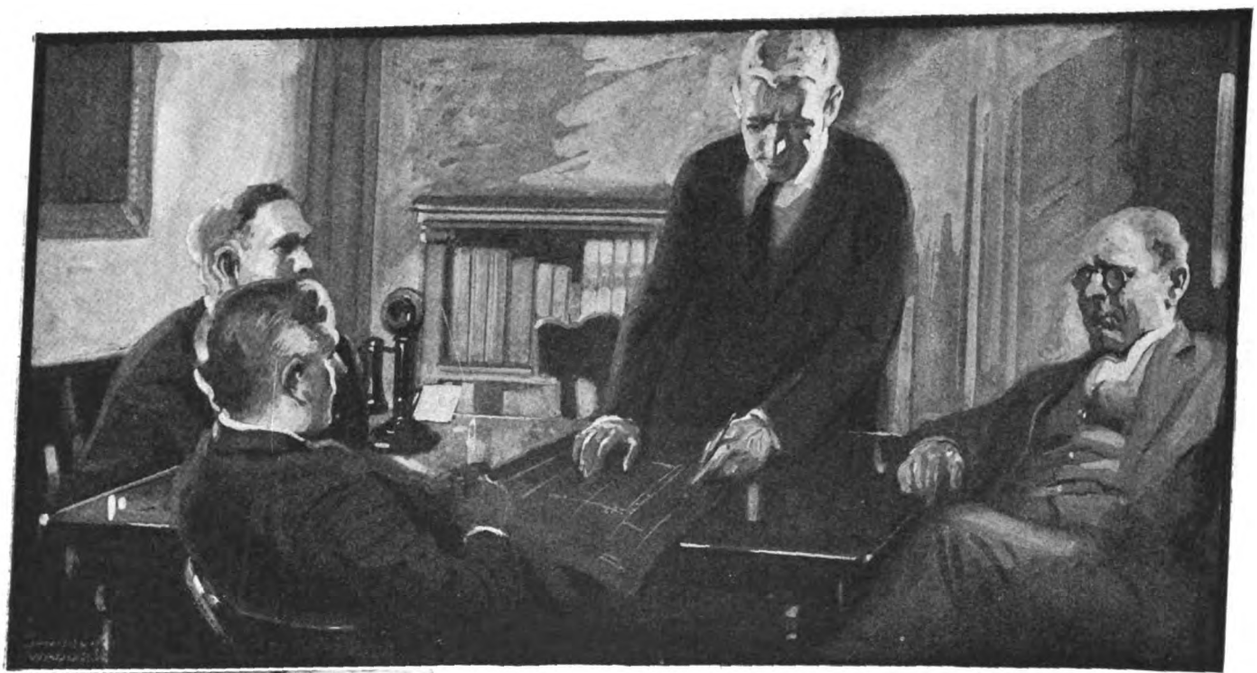
ONE company has cut down its per ton coal crushing cost to one-third the former cost. Another company that handles shale and clay, says its crusher is working as well after 12 years service as when it brought new economies during its first year. A third company that reduces steel turnings claims the crusher pays for itself every five months. No matter what you crush, the rolling rings will do it at the lowest possible crushing cost.

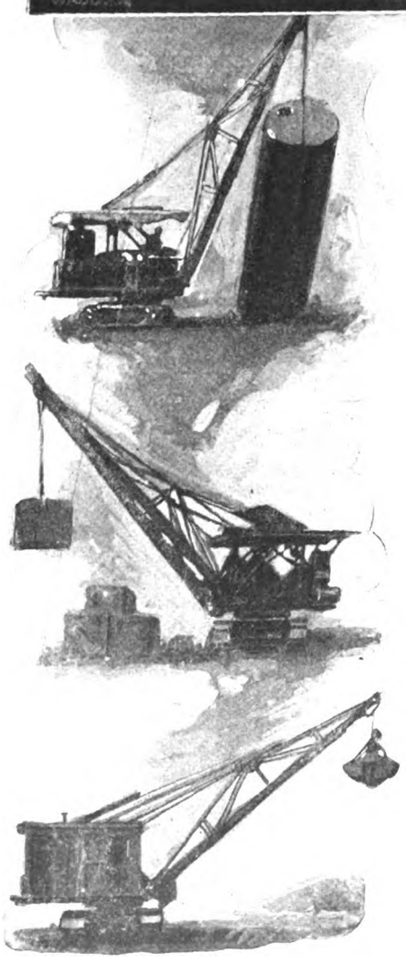
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"Our plant and yard layout is peculiar," explained the superintendent, "here's this long narrow stretch—over here is a pie-shaped yard; with that main portion, wide but short. Yet we wanted to have every part served by material handling equipment.

"Henry suggested calling in a P&H representative and since his company makes all types of cranes, his recommendation as to what type would serve us best was worthy of consideration.

"To make a long story short, with the information he gave us it was a simple matter to see that the P&H Corduroy Crane, because of its ability to maneuver anywhere, and its ease of handling, was the type of equipment most efficient for our purposes.

"The two we ordered will be here in three weeks."

"That suits me," interrupted the G. M. "If these Corduroy Cranes are half as good as the eight P&H Traveling Cranes we have had for the past 18 years, we will get a bigger return on our investment than from any equipment or security I can think of."

* * *

One operator only is required on the P&H—electric or gasoline motor power is provided—maintenance is low because of the high quality of P&H design and construction. Bulletin 40-X shows many illustrations of the P&H operating with grab bucket, magnet, and chain slings. Mailed on request.

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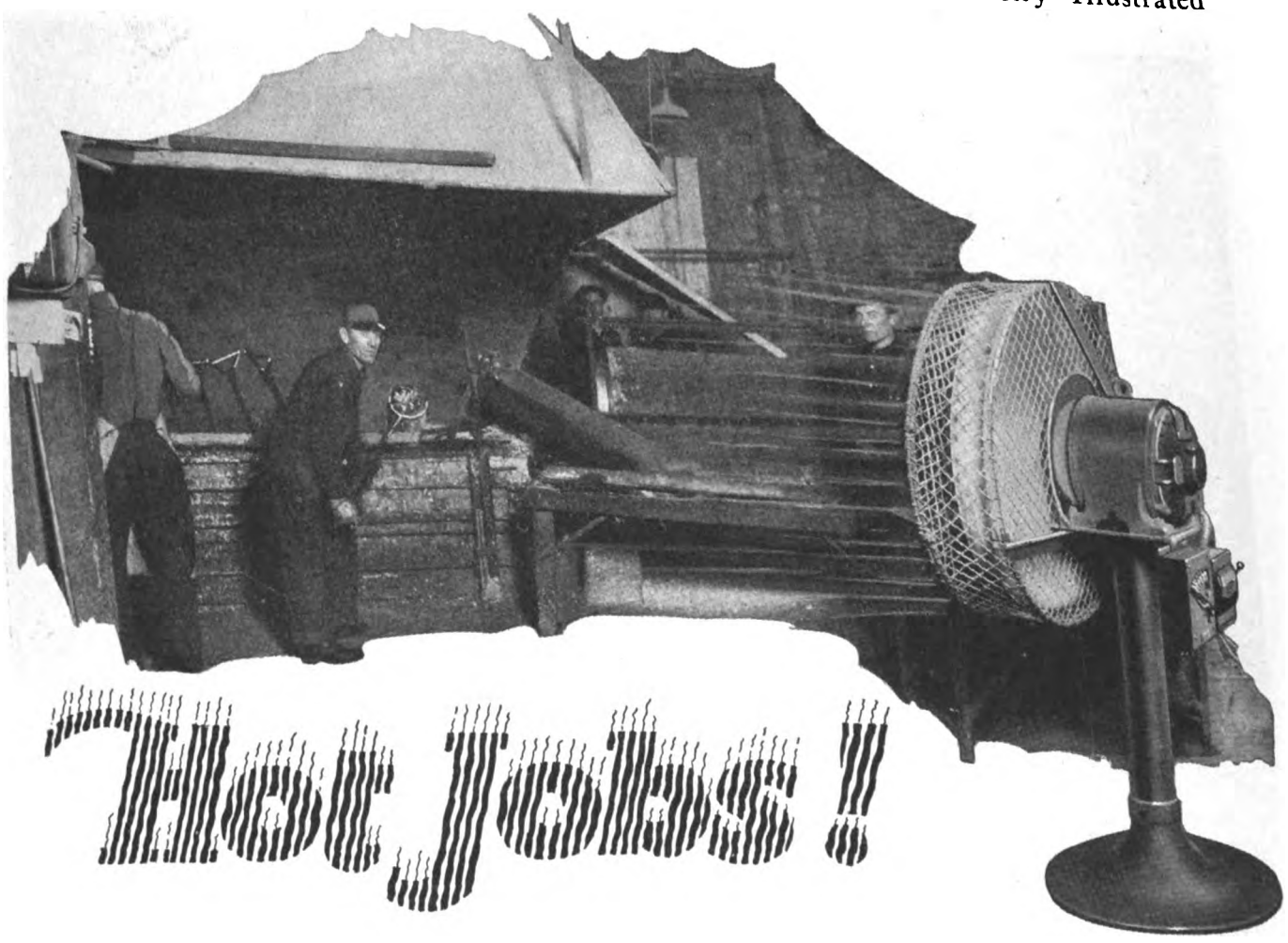
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The effects of a man cooling fan can be felt a hundred feet away. It can be so placed it will cool an entire room—or the strong current of air can be played directly upon a particularly hot job.

Install a Man Cooling Fan and you will rob summer of its toll on your production and pay-roll. Literature on request.

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Industry's Debt to Materials Handling

(*Continued from page* 18)

On our system of Great Lakes many steamers have been equipped with elevators and conveyors so as to make it unnecessary to employ manual labor for their unloading. These ships are used mainly for the handling of bulk materials, such as lime, coal, ore, etc., and not for the handling of miscellaneous freight. Other ships have not been so equipped but the docks and elevators receiving bulk materials by boat have installed many mechanical devices to reduce handling costs and to permit quick ship turn-around. Fig. 6 shows the business end of a mechanical unloader operating in the Port of Buffalo; this bucket, each time it drops into the hold of the ship, picks up seven tons of material and as the bucket can be loaded and emptied a number of times each minute it will be seen that the cargo can be quickly handled. Fig. 20 shows a general view of the same equipment and illustrates how two buckets are used simultaneously to unload the ship. Many other devices are also used for the same operation and there are a number of ports and terminals which are at the present time investigating these devices. What would the steel industry do without mechanical unloaders? Imagine for yourself the cost of steel if all the raw materials had to be loaded to and unloaded from the ships by hand. Who is profiting the most by the installation of this equipment? It would be indeed difficult to say, for while the steel industry is able to make better profits if they employ modern handling methods the consumer and individual is also able to buy good steel at a low price for the same reason.

On the unloading of miscellaneous freight the equipment is necessarily more diversified because of the assortment of packages to be handled. At many ocean ports and lake ports, mechanical ramp conveyors, as shown in Fig. 22, have been installed to overcome the difficulty of accommodating the conveyor to the rise and fall in tide and the difference in elevation which occurs as the load is lightened and the ship rises in the water. On piers and docks where these devices are installed the men operating hand trucks no longer need to pull and haul heavy loads up steep inclines, for by simply stepping on the moving platform they and their loads are quickly transported from one elevation to another. These same ramp conveyors are reversible in direction of travel and can be used to assist in loading.

The platform and large electric lift truck, shown in Fig. 3, is also playing an important part in the handling of miscellaneous merchandise on docks and piers. The size of this platform permits several slings of materials to be delivered direct from boat tackle to storage space without rehandling and as the truck operates on the lift truck principle it is possible for one truck to supply the motive power for a number of platforms.

Fig. 15 shows further use of conveyors in connection with ships. Here we see an installation of materials handling equipment for coaling passenger and freight vessels. At one time ships had to wait on the coaling operation but mechanical devices now deliver coal to ships as fast as they can take it. The installation illustrated is on one of our most important waterways, namely the Panama Canal and each of the loaders shown

(*Continued on page* 56)



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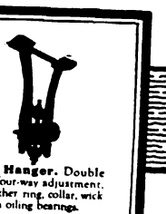
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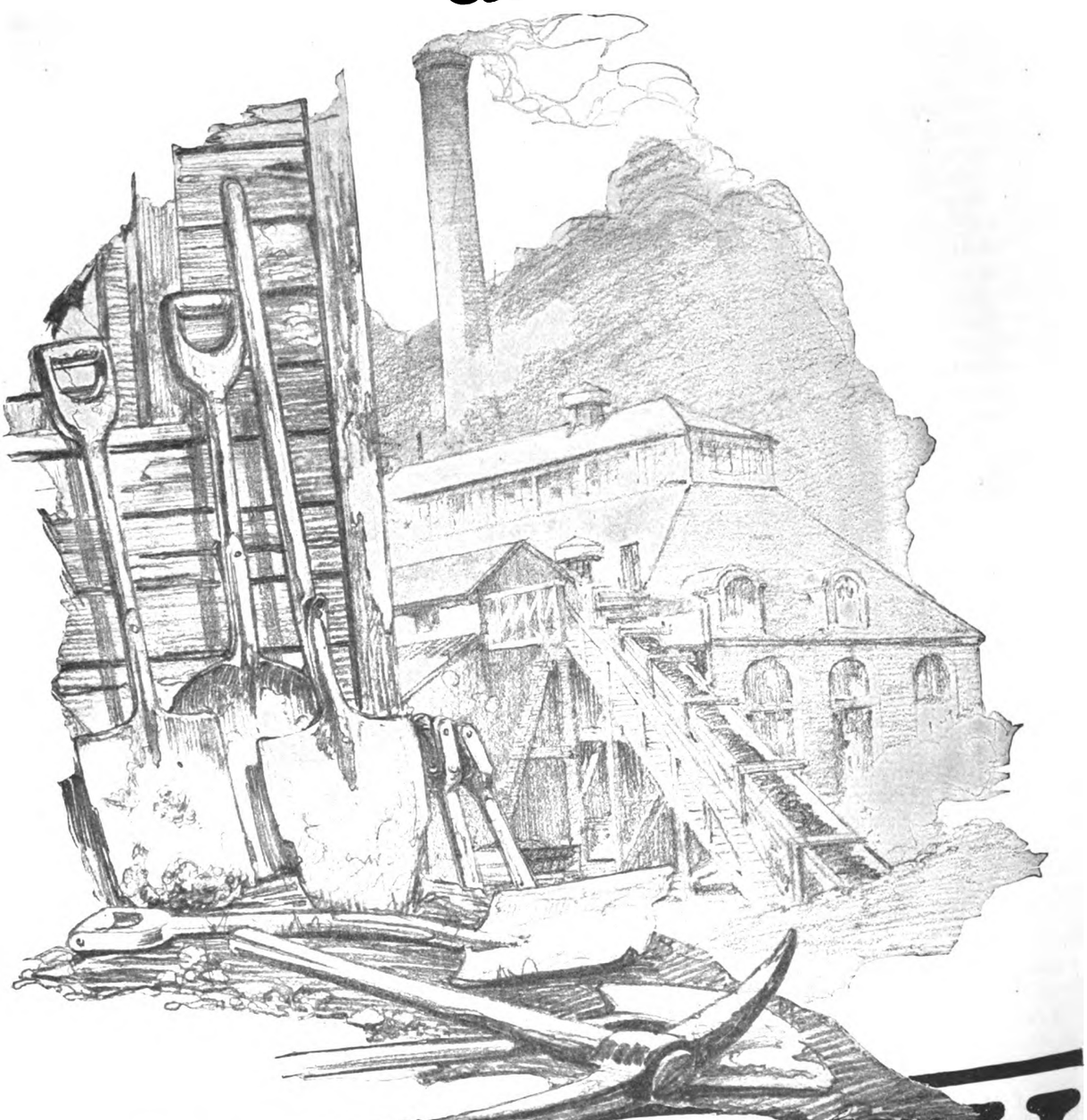
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these tools more productive work

INSTEAD of being tied up on back-breaking tasks, clogging the supply of available labor and retarding production, the men who used these tools are on better jobs—earning more for themselves and the company.

Let the tools accumulate rust rather than your men. Every workman you promote to more productive work helps solve the labor shortage problem.

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Material Handling Equipment is advocated by the Division of Simplified Practice, Department of Commerce, at Washington, as one of the factors that contribute to the elimination of waste in Industry.

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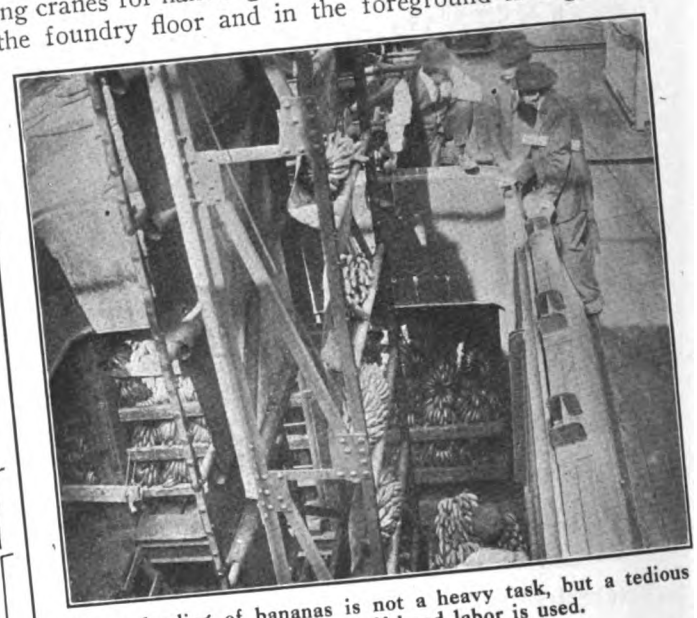
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(*Continued from page* 53)

is capable of delivering coal to the ship's bunkers at the rate of 250 tons per hour.

Foundries are users of iron and steel made from ore which has been previously handled by some form of materials handling equipment, but in the foundry this same iron and steel is again handled many times by mechanical devices and in addition the sand, flasks and other necessary materials in foundry operation are also handled in a like manner. Fig. 4 shows overhead traveling cranes for handling heavy molds, castings, etc., about the foundry floor and in the foreground is a gasoline



The unloading of bananas is not a heavy task, but a tedious and expensive one if hand labor is used.

driven dump body truck, discharging sand adjacent to the molders' bins. Thus we see that again materials handling equipment affects the cost of manufactured products.

To carry this same thought a step further, we will look at Fig. 5, where machine parts are being handled. These parts have undoubtedly been cast in a modern foundry but they are still continuing to be transported by means of conveyors and elevators. In this one illustration three types of this equipment are visible; to the right the castings are being elevated by means of an inclined slat conveyor and are discharged to a short run of roller gravity conveyor, from which they are fed to a horizontal wood platform conveyor, which carries them approximately the full distance of the machine shop. Before these parts are finally assembled into a complete machine they are handled many times.

In sheet metal stamping works it is necessary to immediately carry the finished product away from the presses and for this purpose a belt conveyor, as shown in Fig. 9, has been found very economical. In order to employ this method, however, it is necessary to have the presses properly placed and many old shops are thus handicapped. New shops are now giving consideration to the handling of materials and we find that the presses are being located in reference to the conveyor and the best methods of quick transportation for finished products. The use of such a conveyor not only reduces handling cost but it speeds up production and permits a centralized inspection department and eliminates the necessity of truckers and sorters working about the production machinery.

In plants where quantity production is the rule and

(*Continued on page* 59)

Its safety stops

DEFEAT CHANCE

SAFEGUARD the lifting and carrying of materials in your plant—use an Everedy Portable Electric Hoist.

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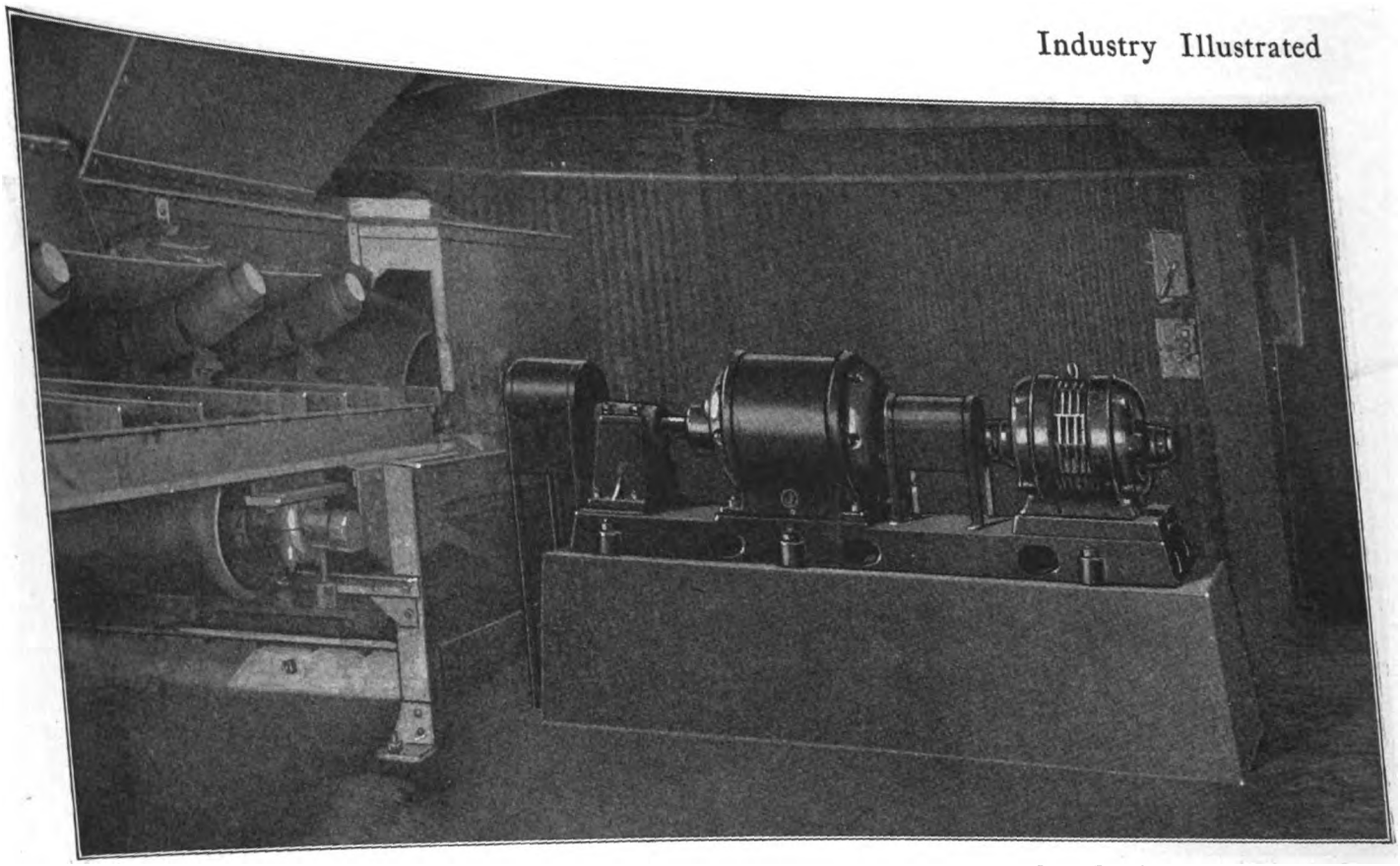
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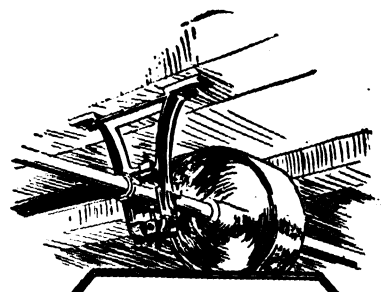
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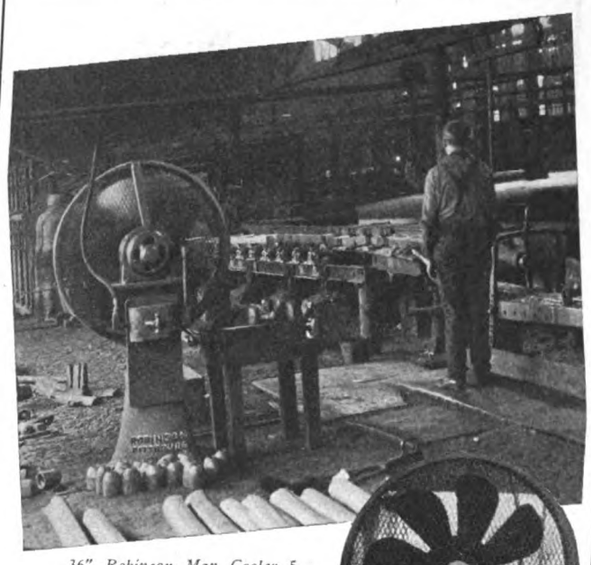
(*Continued from page 56*)

where parts are assembled into complete machines, we find different types of lift trucks assisting in the transportation of materials from one operation to another. Fig. 13 shows a gasoline driven lift truck handling a load of small machine parts in a machine shop, while Fig. 11 shows an electric lift truck handling complete motors. It will also be noted that in the handling of the motors from truck to inspection bench, a jib crane attached to the building column and equipped with a small electric hoist suspended from a travelling trolley is used. This eliminates the necessity of additional men on this operation and the truck driver can also unload the truck.

Chemical plants have long resisted the use of materials handling equipment because of the effect of acids and chemicals on the moving parts and steel work, but today they have found that the savings which can be effected are so enormous that it pays to install this equipment even though the conditions are such that it is necessary to replace the entire installation within one or two years. Equipment such as shown in Fig. 16, however, can be protected by acid-proof paint and thus operate on the handling of chemicals for years, especially on the piling of raw materials and finished products in the plant warehouse. Mono-rail systems, as shown in Fig. 7, can also be used about the chemical plant yard and within the plant and we now find that a number of process buildings are equipped with a crane bay to permit the handling of materials between floors by means of overhead cranes; in fact, in the chemical industry all types of equipment have their proper application and with proper attention and maintenance this equipment will frequently outlast more expensive process machinery.

The warehouse industry has long been satisfied to employ the same methods which have been in vogue for generations but today the industrial executive and the buying public are demanding cheaper warehousing and upon investigation it has been found that the greatest item of expense, especially in distributing warehouses is the handling charges. Many warehousemen who have not separated the item of handling from the item of storage in determining their charges to customers have been losing money without knowing the reason why. At the present time, Warehousemen's Associations and Chambers of Commerce are investigating the field of materials handling equipment in this industry and many of the new municipal owned warehouses, such as are located at the Port of Seattle and the Port of Houston, Texas, are well equipped with materials handling machinery. Fig. 16 shows a portable elevator operating in the warehouse of a chemical plant, but these same devices are also being employed in public warehouses. Overhead cranes, such as shown in Fig. 12, are also being worked into the new types of warehouses and an ideal combination is to build two-building units, as shown, placing the railroad tracks on the ground floor and the overhead crane at the top of the building, enclosing this space in glass so as to permit efficient light. At the different floor levels will be seen balconies for unloading from the cranes to the various floors.

The paper industry has been very progressive in the use of certain types of cranes, lift trucks, and other handling machinery and the reason for this is the unwieldy nature of the finished product. The handling



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of roll papers, as shown in Fig. 14, by hand methods, would be difficult and if the ceiling was not utilized for transportation the every movement of the finished product would seriously delay production operations.

It is a peculiar thing that all industry is dependent upon the proper handling of materials, and yet it is necessary to continually point out why more extensive use of mechanical means of handling should be employed. Each step in production is tied together by transportation, and not only is materials handling equipment necessary to production but it is also an essential part of the central power station which develops the necessary electric current to drive industrial machinery. Fig. 17 shows the exterior view of a central power plant and the buildings visible contain elevators, crushers, conveyors, etc., for preparing the coal, which is unloaded from railroad cars by means of skip hoists and locomotive cranes. In the handling of coal from mines to the ash pile all forms of materials handling equipment are used. It might therefore be said that cheap steam power is dependent in a large measure on the economical handling of coal and it will be agreed that mechanical elevators, conveyors and equipment as shown will do much to reduce handling costs.

Even during the building of industrial plants and other enterprises the use of some form of materials handling equipment, such as derricks, cranes, belt conveyors, elevators, etc., is essential. On every large construction project, and even on some of the smaller ones, many installations of this equipment are reducing the cost of building.

It would seem that the evidence presented in this one article alone should be sufficient to cause industrial executives to immediately start a complete investigation of their handling problems, but for some unknown reason they are still slow in grasping this opportunity of benefiting their own industrial enterprise as well as those dependent upon their production. Experience has taught the writer that this is not always the fault of the plant engineer, plant manager, or even the executives higher up, but it is due to the lack of knowledge and the proper appreciation of the subject by the board of directors, who must pass on appropriations for plant improvements. It is therefore necessary to educate Industrial America not only from the bottom up but from the top down on the subject of materials handling. The unskilled laboring man in the shop at one time resisted the installation of any form of materials handling machinery, but today this same class of labor is rebelling and frequently refuses to work unless it is assisted by mechanical devices. The laboring man now realizes that materials handling equipment is not "Labor-Saving" but "Labor-Assisting" and "Labor-Promoting" and in many cases the management of various industries have been told by their laboring men where to place such equipment.

It is frequently difficult to obtain increased capital from banks for industrial enterprises or even through the sale of stocks and bonds and for this reason industrial executives should consider the installation of materials handling as a source of increased capital for their business. The writer at one time, and within the space of a year, made the enormous saving of $150,000 in labor-cost alone for one company by installing materials handling equipment and this saving was over and above

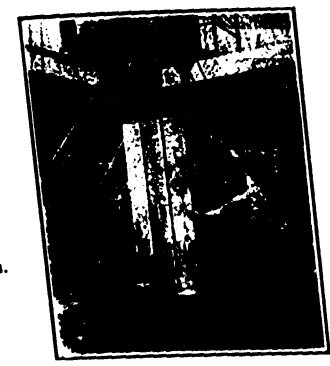
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Reduce Freight Rates *in* Your Plant

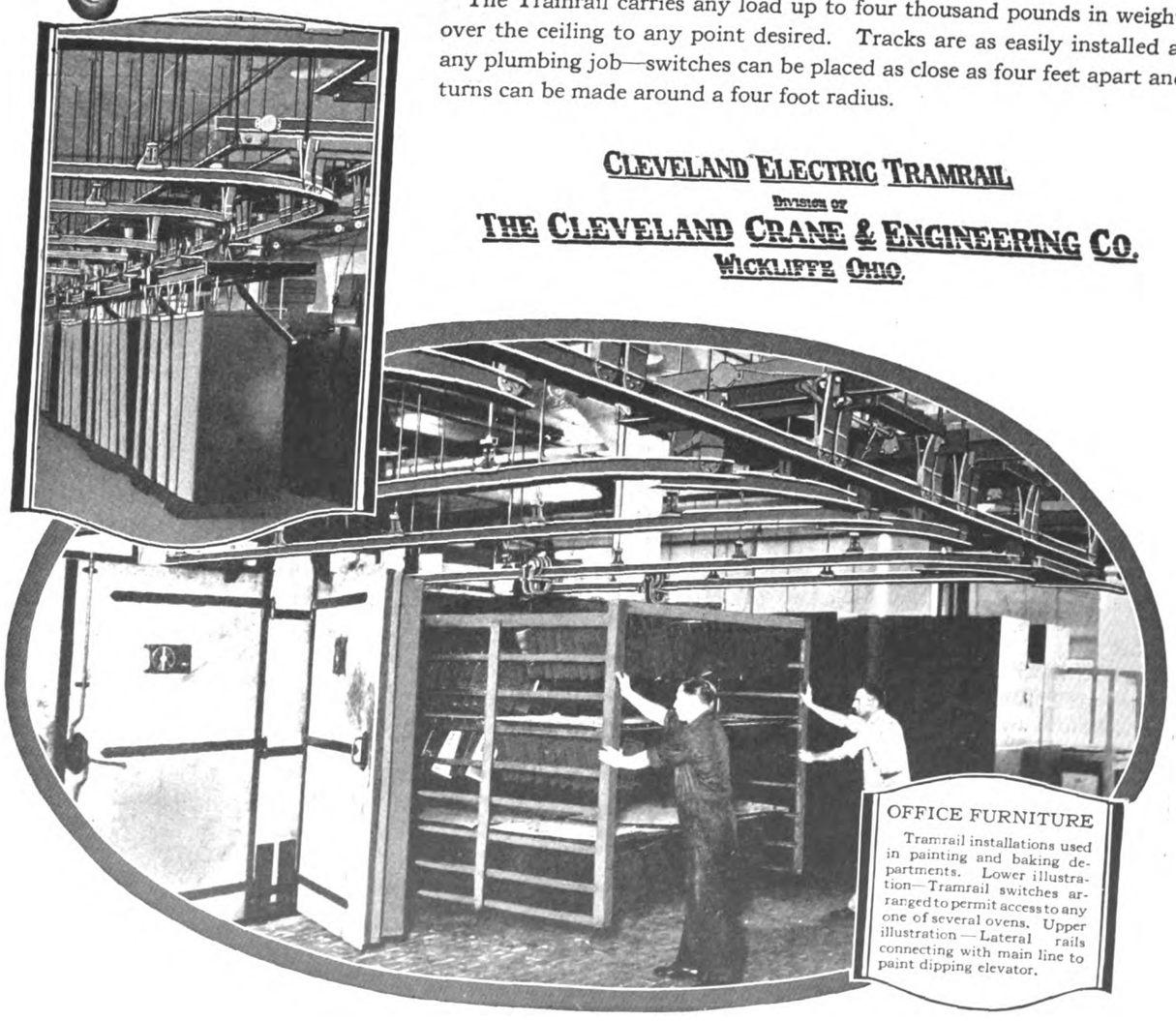
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Many manufacturers complain of excessive freight rates on raw materials and finished goods, both of which hold up the selling prices of their products. Few seem to have considered the effect that high *inside* transportation charges have on production costs.

Reduce freight rates in your own plant by avoiding wasteful and expensive hand methods. The Cleveland Electric Tramrail has been designed to cut intra-plant freight costs to rock bottom.

The Tramrail carries any load up to four thousand pounds in weight, over the ceiling to any point desired. Tracks are as easily installed as any plumbing job—switches can be placed as close as four feet apart and turns can be made around a four foot radius.

CLEVELAND ELECTRIC TRAMRAIL
DIVISION OF
THE CLEVELAND CRANE & ENGINEERING CO.
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OFFICE FURNITURE

Tramrail installations used in painting and baking departments. Lower illustration—Tramrail switches arranged to permit access to any one of several ovens. Upper illustration—Lateral rails connecting with main line to paint dipping elevator.

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Do You Lose Money *Between* Machining Operations?

EVEN if your plant is equipped with the most modern production machinery, there is still a big chance for you to lose money *between* machining operations?....Why? Simply because you may not be *moving* your material with dispatch, or economy (i. e. low labor cost).



Curtis All-steel *Air* Hoists and Roller-bearing Trolleys lift and move any kind of material, quickly, economically and safely, making use of a power already available in most plants. They save time and energy and men—before, during and after machining operations. With Curtis I-Beam Trolleys a 4000-lb. load can be moved by a 50-lb. pull.

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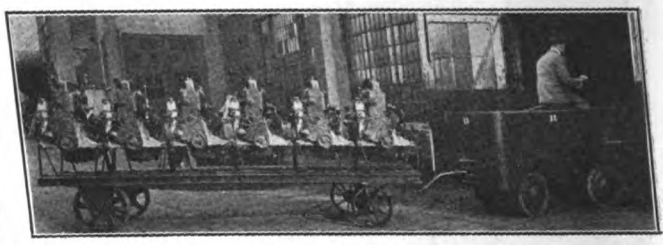
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CURTIS

(*Continued from page* 60)

the cost of equipment, its installation, and expenses incurred in investigating. We must stop to realize that $150,000 is equal to 6% interest on $2,500,000 borrowed for one year or we can figure that this equipment would save approximately a half a million dollars ($500,000) in three years, which could be re-invested in the business. There is an old saying "That money saved is money earned," and we all know that the easiest place to borrow money is from one's own bank account and while this applies to individuals it also applies to industrial enterprises; it is for this reason that large surpluses are accumulated and held in reserve.

Industry as known in this country could not operate and mass production would be impossible without the use of mechanical power, and as previously stated materials handling equipment is one of the biggest factors of mechanical power. Industry is therefore indebted to materials handling to an extent that would be hard to estimate and this indebtedness is accumulating as more and better devices are being developed to assist and



Tractors and trailers, both large and small, play an important part in intra-plant transportation.

facilitate the proper coördination of other mechanical production machinery.

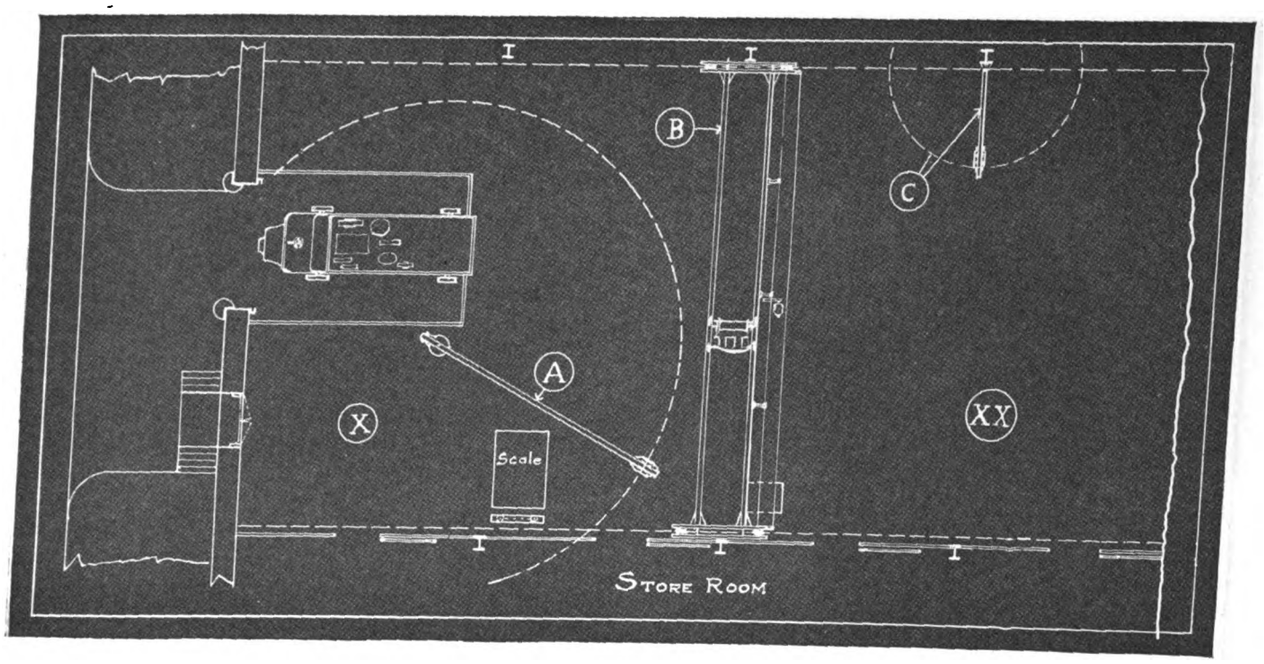
The subject of materials handling is now gaining momentum and more Engineers, Industrial Associations, Chambers of Commerce and Executives are becoming conversant with the various types and makes of this class of equipment. Formerly it was a subject which could only be spoken of in a general way, but today it can be spoken of in a specific manner because there are few industries in which some of this equipment is not employed. This does not mean that all plants are equipped, for there are still executives who need educating.

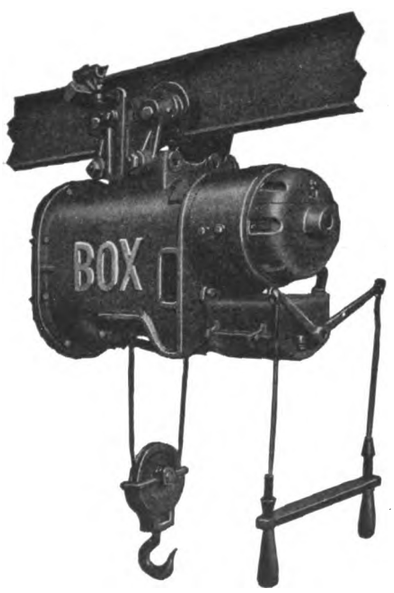
Industry owes a big debt to the persistent and consistent efforts of the materials handling manufacturers, who have for years patiently and thoroughly, at their own expense, placed before the industrial executives one of the greatest factors in the economical scheme of industrial management.

Editorial Credit Notice

IN the article entitled, "The Pneumatic Conveying of Materials," published in the January, 1924, issue of INDUSTRY ILLUSTRATED, we failed to give credit to Mr. E. G. Phillips, from whose book "Pneumatic Conveying," published by Sir Isaac Pitman & Sons, Ltd., of London, a number of important extracts were made. Mr. Phillips is an authority on this subject, and we regret the oversight which unintentionally deprived him of the credit for his work.

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A LIFTING AND SHIFTING SUGGESTION

The drawing shows an actual BOX installation designed to handle quickly and economically all classes of material in a manufacturing plant. The Lifting Equipment comprises:

A. BOX Self-Supporting Jib Crane used to handle all incoming and outgoing material to and from trucks at shipping platform. "Load Lifter" equipped.

B. BOX "B" Electric Traveling Crane used to lift and carry material from all parts of erecting floor to machines and shipping platform.

C. BOX Bracket Jib Cranes perform a quick lifting service of parts to and from machines. "Load Lifter" equipped.

X. Shipping platform. XX. Erecting floor.

The smaller Cranes with "Load Lifters" wrote their entire cost off in a short time by the saving in the cost of power which the Heavy Duty Crane would have used in doing the tasks which were "Load Lifter" work. In addition the Heavy Crane was released for more important work. Again there was no work tied up—waiting for the big Crane.

THE ELECTRIC LOAD LIFTER

With the "Load Lifter" one man does quicker, better lifting than previously with three to five human helpers. It is quickly hung, inside or out, or installed on I-beam track or from ceiling. The "Load Lifter" is made in one frame of two capacities—500 and 1,000 lbs.—and is helping many industries to greatly cut lifting costs.

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Alfred Box & Co., Inc., are also builders of the "Box Crane" — a standardized, heavy duty, Electric Travelling Crane in capacities of twenty tons and under; also builders of hand operated Travelling and Jib Cranes of any capacity. In addition full line of Electric Hoists to five tons capacity—embodied in which are all the important features found in the "Load Lifter."

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Systemizing Motor Production at Schenectady

(*Continued from page 23*)

termed a "flow" of standard component parts rather than a stationary stock. While a goodly portion of the call from the commercial departments is for standard types, there are many deviations from these standards. The parts which make up the many types of motors, however, are common to 90% of the various processes of motor manufacture.

In order, therefore, to provide for the continual call for motors of both standard and special types, it is necessary to establish some means of having standard parts available. The first step taken at Schenectady is to authorize the manufacture of a definite quantity of standard motors over a given period of time. In following this procedure, the available supply of given parts is never more than sufficient to make up an even quantity of standard motors with no extra semi-finished parts left over. Production proceeds uniformly and, at any given time, the individual parts which make up the finished motor are evenly advanced in the process of manufacture.

Under this arrangement, standard motors are provided for. Based on estimates furnished by the commercial department covering future orders, this quantity manufacture covers the general call for standard machines of certain definite ratings. These estimates and manufacturing authorizations are reviewed every two months. After the motor schedules are prepared covering any specific period of time, the motors themselves in each schedule are "exploded" into their component parts and "component part" schedules are prepared and furnished the factory foremen in the motor department, each foreman being furnished with a schedule covering the line of manufacture under his supervision. It is important here to note that it is always the constant endeavor of the schedule-makers to regulate the speed of production to cover the estimated requirements of the commercial department, this being done to avoid the accumulation of a non-moving stock.

Were the manufacture of motors confined to standard types, such a procedure would be comparatively simple. In the customers' orders received from week to week, however, there are both semi-standard and special types of motors called for. The motor department, therefore, prepares each week a smaller schedule covering that week's orders for semi-standard or special motors, this schedule, in turn, being exploded into its component motor parts, 90% of which are standard in type. The special parts called for are made up in the factory on special authorization and, when completed, are assembled with such standard parts as required to make up the complete motor, these standard parts being taken from the regular production schedule. The vacant spaces in this schedule made by these special withdrawals are filled by the explosion of the weekly schedule, the standard parts of which are placed on the larger schedule, merging into the regular flow of production.

In this way, a standard production is maintained and the continual flow of orders from week to week taken care of. But provision must be made for orders which require rush delivery. These "rush orders" are handled throughout on a special basis and given preference over



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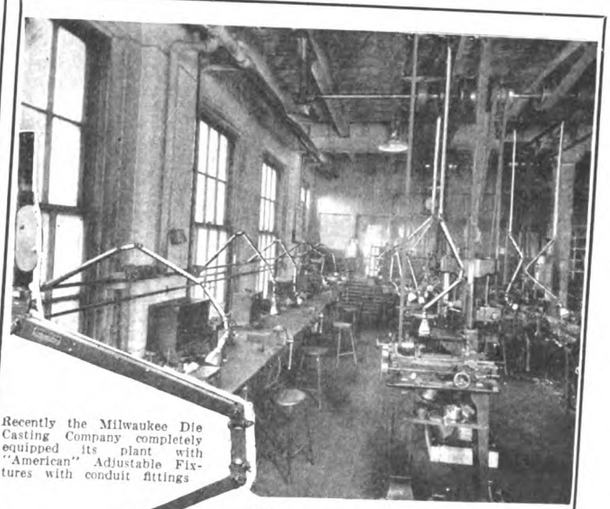
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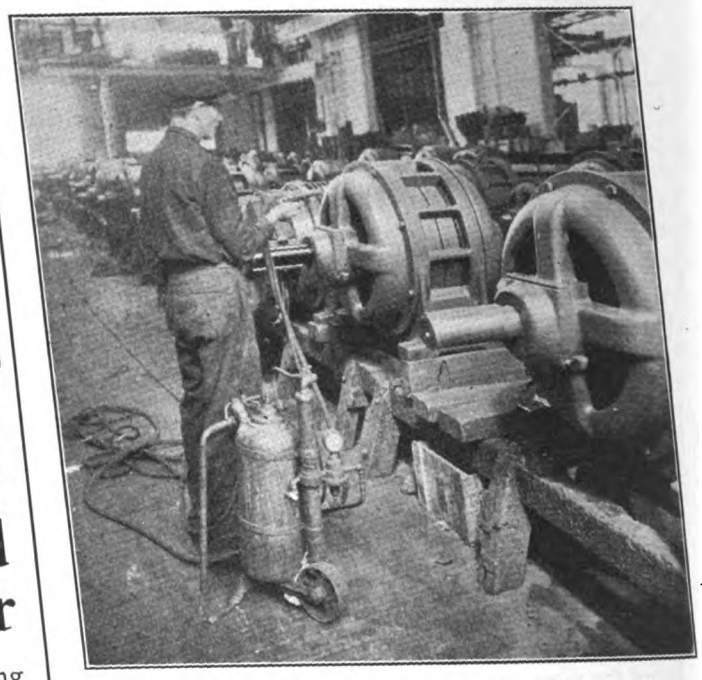
Jenkins Valves

SINCE 1864

all other production. Their standard component parts are added to the large schedule, but the parts of a motor actually shipped on a rush order are taken, if standard, from those at the point of completion. If special, those parts which are of a special nature are made up on a special basis and assembled with standard parts, always on a rush basis, for quick shipment.

In the actual manufacture of a motor, the first question to be given consideration is the obtaining of raw material. The grey iron castings used in the standard motor production are all designed for machine moulding and require very few cores. This contributes greatly to the quality of the castings, as well as economy of production, but requires large orders to realize the saving. The long range production schedules on standard parts already mentioned provide accurate information as to future requirements and permit the bunching of orders for castings, in order to secure the largest possible foundry runs without danger of overstocking.

Certain materials, such as sheet steel for punchings,



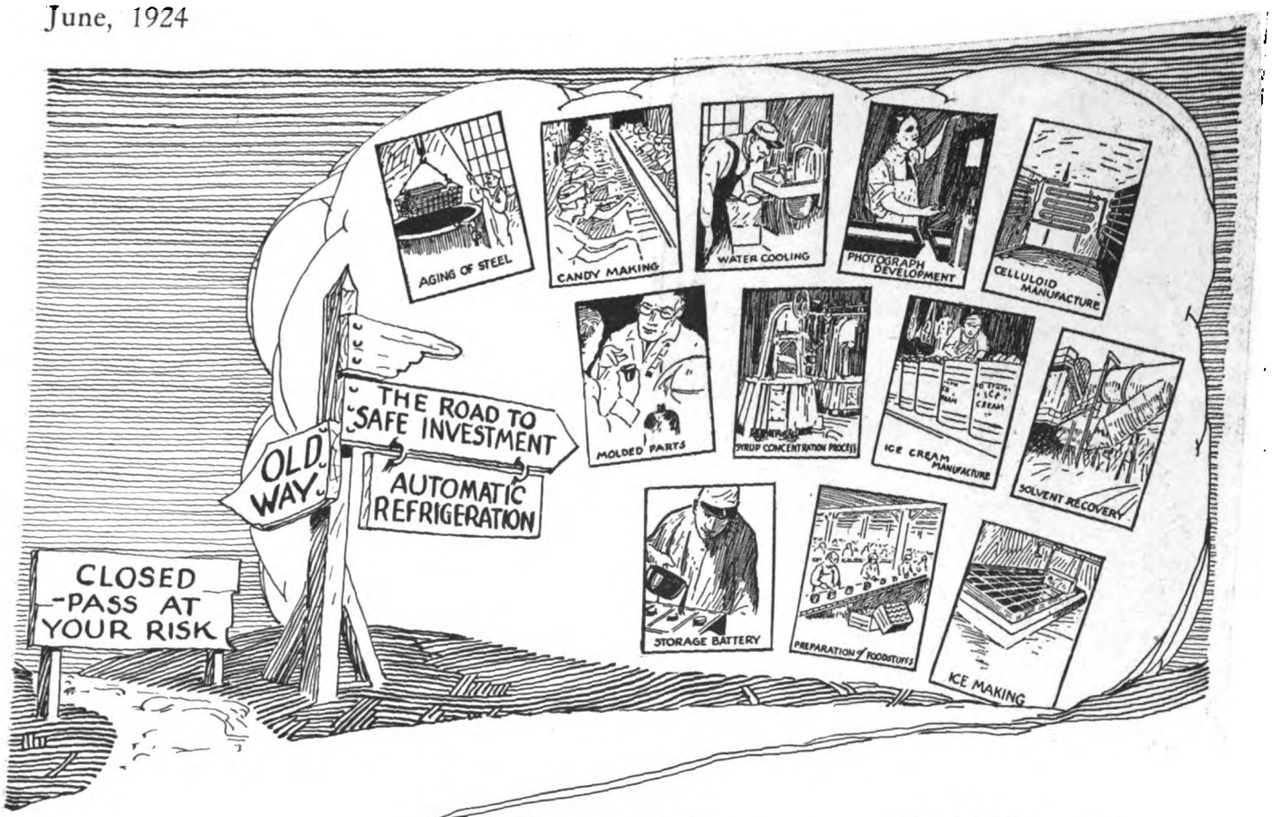
Painting motors, after they have passed final inspection.

shafting steel and, at times, copper wire, generally require so long to obtain that they must be ordered in advance of the time when production schedules are issued. To cover this, a buffer stock is set up which represents a few weeks' average consumption of each size ordinarily used. This covers the lag between the withdrawal for a given schedule and the receipt of material ordered when the schedule is issued.

In the sizes of motors made at Schenectady, all have a stator spider, or frame, of cast iron. This serves to hold the punchings, or magnetic core; to support the bearing brackets, and is provided with feet by means of which the motor is attached to its base, or foundation. The machining of this stator spider is arranged in order that these three functions may best be co-ordinated. The feet bottoms are first milled off to provide a surface for mounting the spider on the boring mill. The bore for the punching is finished to exact size and the ends rough-faced. The next operation is to broach the slots in the ribs of the spider. These slots

(*Continued on page* 68)

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New Solutions of Old Problems

Industrial executives are on the right road. They are looking forward and using every means to improve conditions and to increase production. That is why they are using Automatic Refrigeration.

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You could pave a line around the world with the parts this machine has counted!!

FOR 17 years the dormant type National Counting and Weighing Machine pictured above has been, together with another machine purchased a year later, in constant daily use in the Detroit Lubricator Co.'s plant. At last accounts both these machines were performing with undiminished accuracy, equalling that of more improved models that were installed at later dates.

The machine is shown counting heavy brass castings in tote pans—handling truck loads of from 18 to 24 pans in one operation.

National Counting and Weighing Machines not only save heavily in time and labor on counting operations but their long life often makes the fixing of a yearly depreciation charge-off decidedly more a figure than a fact.

National Counting and Weighing Machines are made in Counter, Portable Platform and Dormant Models. They Count—they Weigh—they Measure lineal or square measure contents. A complete description of various models will be mailed on request.

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NATIONAL COUNTING AND WEIGHING MACHINES, NATIONAL CALLING SYSTEM, NATIONAL "ADJUSTABLE" STEEL SHELVING, NATIONAL "ROCKER-LIFT" ELEVATING AND SCALE-ELEVATING TRUCKS.

NATIONAL COUNTING AND WEIGHING MACHINES

(*Continued from page 66*)

receive the tags on the outer surface of the punchings. After this, the holes are drilled in the feet and in the ends for the bracket bolts. The spider is then ready for the assembly of the punchings.

The stator punching segments are made from a special grade of thin sheet steel. Here again quantity production is a large factor in the determining of the method of manufacture. Where the demand is large and continuous, expensive combination dies for cutting out the slots as well as the outline of the segments can be mounted on presses equipped with automatic feed. Where the demand is light or irregular, however, the punchings are blanked and later notched on indexing presses, at a greater labor cost per unit but less die cost.

After the segments are punched, they are placed in annealing ovens for several hours and then coated with enamel, this serving to insulate between adjacent layers of the core. The punchings are then ready to be stacked in the stator spider. This stacking is a hand operation, done by girls on the smaller sizes. The core is then subjected to heavy lateral pressure with a simultaneous expanding force holding the punchings back against the ribs. They are then secured in this position by keying the clamping flanges in place.

The assembled core is then placed on a mandrel and the ends of the spider accurately faced and recessed for the bearing bracket flanges, after which it is ready to receive the coils.

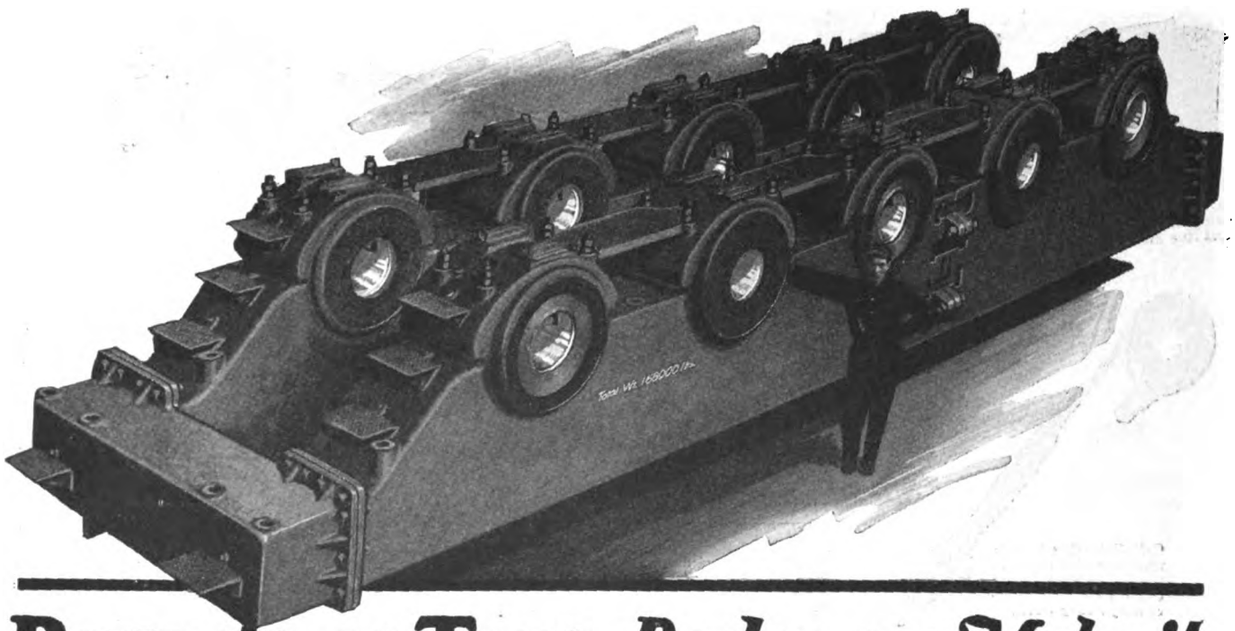
The operations up to this point do not differ greatly from those encountered in the general run of machine shop work. In the making of the coils and the installing of windings in the cores, work of an entirely different character is encountered. Lathes, milling machines, punch presses and practically every tool needed can be purchased from machine tool builders to perform the machining operations, but there is practically no machinery which can be bought on the market to help in making the windings of a motor. Nearly every tool and labor-saving device used in this part of the work is home-made and progress in new developments along these lines is necessarily slow. The past fifteen years, however, have shown marked improvement both in lower costs and better quality of product achieved by the introduction of new devices for making coils.

Except in the case of coils for the smallest motors using round wire in random formation in the slots, the great majority of the coils are made of rectangular shaped double cotton covered wire. The use of this rectangular wire tends very greatly to increase the variety of sizes over that found necessary with round wire, and this adds to the difficulty in maintaining proper stocks of wire. The economy in slot space and improvement in the motor, however, fully justify this increased complication.

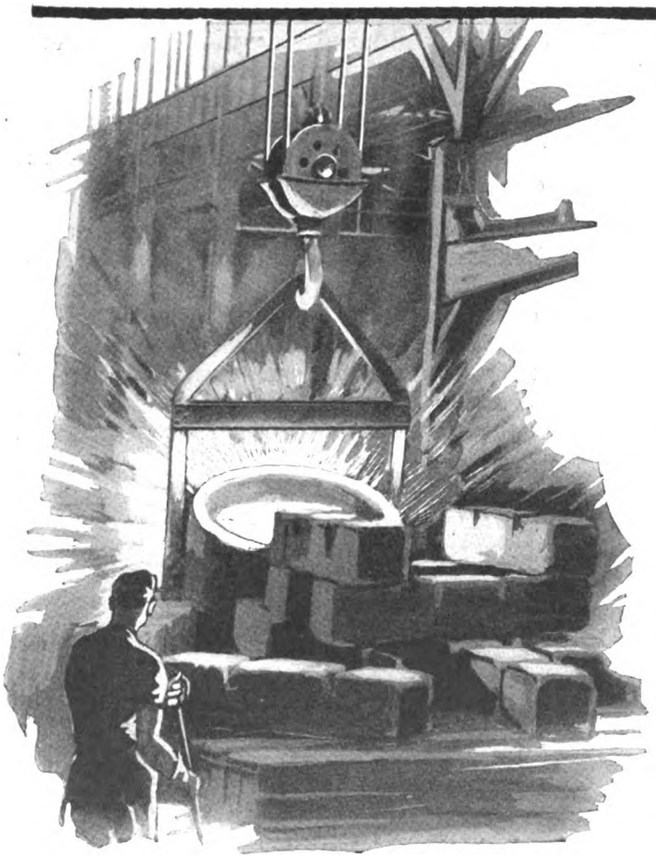
The wire is first wound by boys into a flat coil of the required number of turns, the ends cut to length and wires tied by hand with cord in several places to hold the coil in shape until it can be moulded. Next, in a combined steam and electrically heated mould, the wires in that portion of the coil which fits into the slot are cemented together and, with great pressure and high temperature, are brought to exact size and then chilled before being removed from the mould. The pulling machine then forms the coil into the six-sided shape neces-

(*Continued on page 72*)

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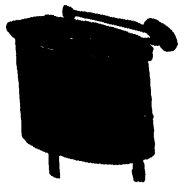
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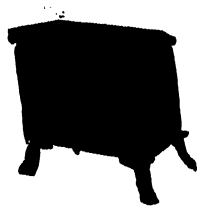
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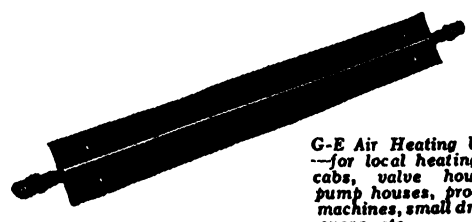
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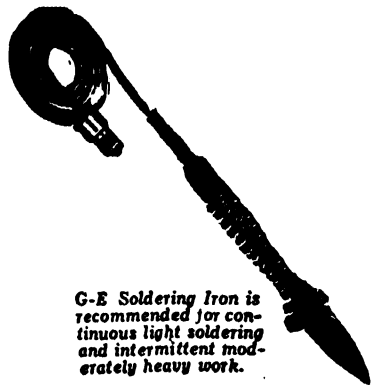
G-E Compound Melting Pot—melts battery compound, sealing wax and like materials.



G-E Self-Regulating Solder Pot insures economy and convenience in melting solder.



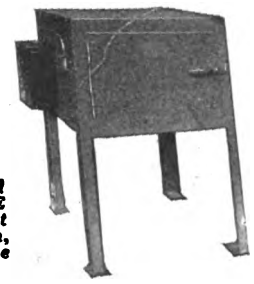
G-E Air Heating Unit—for local heating in cabs, valve houses, pump houses, process machines, small drying ovens, etc.



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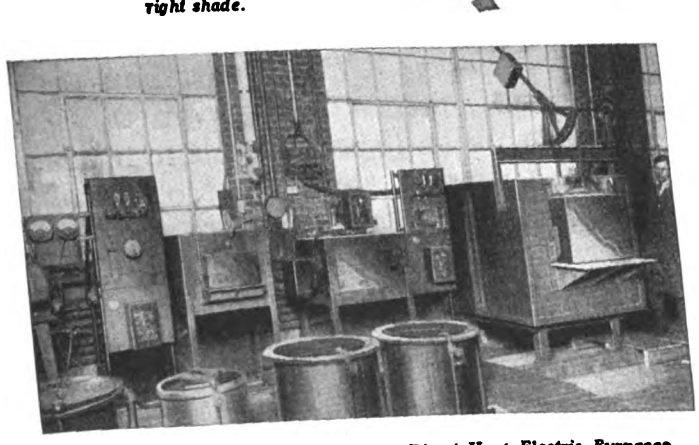


Carbon steel tools, parts and hardware drawn in the G-E Air Tempering Oven, come out clean; the temper is uniform, and the surface color of the right shade.

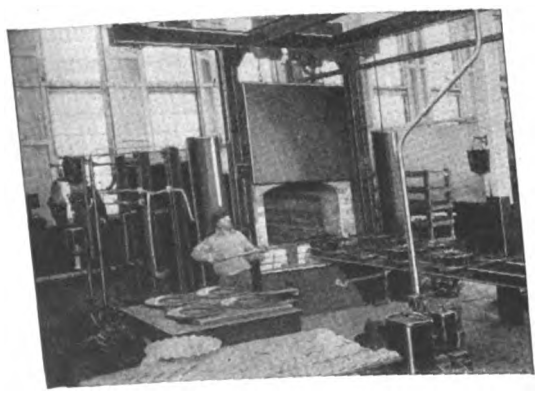
Electric Heat—quick, clean, safe, flexible, economical! Its advantages over other methods have so extended its use and development that it embraces applications that are vital in the heating processes of all kinds of industry.

It is readily adaptable to working conditions—can be used in any atmosphere—can be produced in just the exact amount and at the desired temperature. It is subject to accurate control both as to temperature, quantity, and distribution—which specific conditions can be duplicated at will.

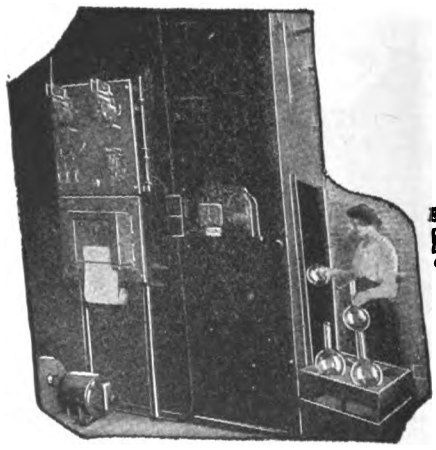
The General Electric Company builds heating units that are easily installed in the little box oven or the immense conveyor type ovens and furnaces. The G-E Direct-Heat Units with non-oxidizing ribbons are 100 per cent efficient in converting electric energy into heat that speeds production and reduces spoilage.



Installation in a heat treating shop of Direct-Heat Electric Furnaces manufactured by the General Electric Company.



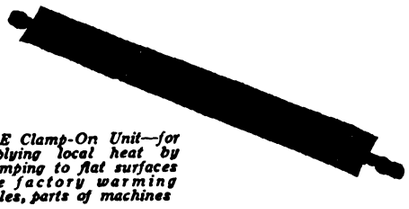
Electric vitreous enamel furnace equipped with G-E Direct-Heat Units and Automatic Temperature Control.



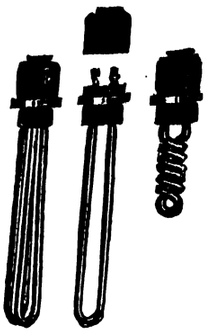
Electrically-heated glass annealing lehr equipped with G-E Direct-Heat Units and Automatic Temperature Control. The electric lehr gives just the right time-temperature cycle, and practically eliminates rejects.

GENERAL

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G-E Clamp-On Unit—for applying local heat by clamping to flat surfaces like factory warming tables, parts of machines etc.



G-E Immersion Heaters make the most reliable installations for electrically heating water and oils in industrial processes



G-E Jacketed Glue Pot effects big saving where glue is used only at intervals.

Is Electric Heat

dustrial heating processes

These units are compact, easily installed, and their flexibility makes possible the most desirable location of each individual heater. By combination of these units all requirements can be met for the utilization of heat over a wide and varying range in ovens and furnaces.

The General Electric Company also manufactures small industrial electric heating devices for handy use about the plant—giving to industry the broad use of electricity for practically every heating purpose. It is the originator of "Helicoil" Sheath Wire which has made possible the development of many of these devices.

Industrial Heating Specialists of the General Electric Company are ready to serve you in making recommendations covering the installations of electric heating equipment for many heating processes in your plant.



G-E Jacketless Glue Pot saves where glue is used continuously during the day. Maintains just the right temperature without attention.



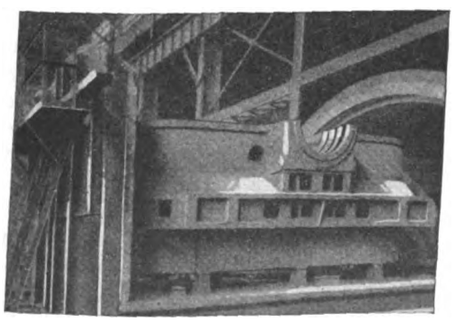
Cartridge Unit, originated by General Electric Company, is unexcelled for concentrated local heating of tools and machine parts.



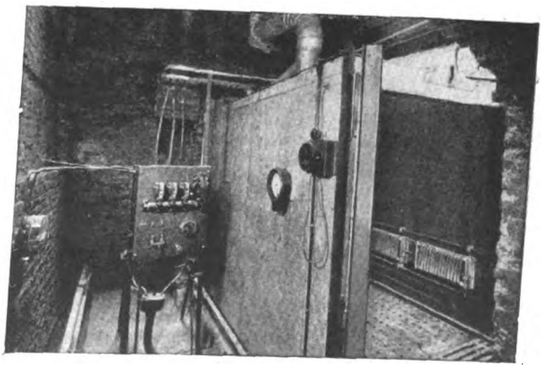
Baking, drying, and other oven processes are improved by the utilization of electric heat. G-E heating equipment with automatic control is used most extensively in this field.



G-E Oil Tempering Bath—compact, self-contained electrically heated device for tempering carbon steels.



Annealing 50-ton turbine casting in electric furnace 27 ft. long by 16 ft. wide by 9 ft. high equipped with G-E Heating Units and Automatic Temperature Control.



G-E Direct-Heat Units installed in electric oven. These units eliminate muffles and their maintenance.

38-114

ELECTRIC

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(*Continued from page 68*)

sary to fit into the slots without further deformation. The coil is now ready for the insulation. Girls apply this both in the form of varnished cambric cloth wrappings and in the form of tapings of untreated linen tape, later filled with varnish. Many coats of insulating varnish are required to build up the film necessary to withstand the high potential tests later given. Each coat or dipping is followed by eight to ten hours' baking in an oven heated to 100° C.

The coils are then ready for assembly in the stator core. This is done entirely by hand. They require great care in handling, as any bad scratches or breaks in the insulation will cause punctures in the weakened spots when the over-voltage tests are later applied. After all the coils are finally in place and wedges driven to hold them fast, they are connected together in the proper pole and phase groups. This work requires a great deal of experience in order to avoid mistakes.

The wound stator is now ready for final assembly.

The story of the construction of the wound rotor is much the same as that of the stator, with the exception of the shafts, which are made on lathes and finished on wet grinders to very exact diameters. The squirrel cage type of rotor is somewhat different, inasmuch as the windings are not insulated from the magnetic core. In the smaller sizes, the squirrel cage windings are made of aluminum and cast in the slots and end rings. In the larger sizes, copper bars are forced into the slots and then welded to copper end rings. The final operation on the rotor, after its core is turned true with the shaft, is to balance it. On high speed motors it has been found necessary to give the rotor a running balance at full speed.

The machining of the bearing brackets of the motors below 100 horsepower can be very nicely done on semi-automatic lathes. This operation, together with drilling, covers practically all the work on these parts.

The bearings for standard motors are made in sufficient quantities to warrant quite extensive use of automatic and semi-automatic lathes and special tools and fixtures. The standard bearings are made from heavy steel tubing cut to length and each end recessed on automatic lathes, babbited in centrifugal machines, finished inside and roughed outside on semi-automatic lathes and finished ground outside by hand.

This roughly covers the manufacture of the three main parts of the standard motor. The manufacture of these parts, when completed, is so scheduled that they arrive in the assembly department at the same time. They are then assembled together and passed into test to be run and for the recording of electrical data. In the electrical test, such mechanical defects as tight bearings, end thrust due to magnetic pull, unbalance and unequal air gap are discovered, as well as any mistakes in coil connections or other winding work. Incidentally, this testing work serves as a training course for technical graduates before they take up work in engineering offices.

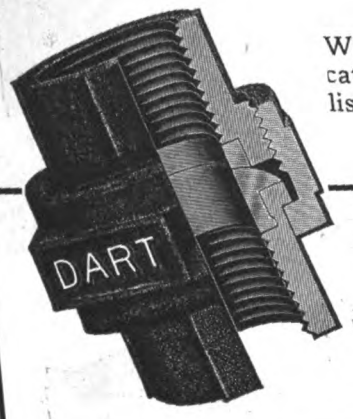
After the electrical test the motor is given a very careful final inspection, painted and is then sent to the shipping department to be delivered to the customer.

Use *All* Your Steam—

That's what you make it for—not to waste it in transmission.

Dart Unions are waste eliminators; being absolutely leakproof, they entirely eradicate losses from steam reduction and replacement of defective fittings.

There's no union like the Dart for your pipe lines; they require no packing, are adapted to high or low pressure and are made in all styles and sizes.



Write for sample, catalog and price list.

E. M. DART MFG. CO.
Providence, R. I.
Sales Agents
THE FAIRBANKS CO.
Canadian Factory
DART UNION CO., LTD.
Toronto, Canada



"the writing on the wall"—

YOU'LL find the writing on the furnace wall in the joints between firebrick — the source of nearly all furnace failures.

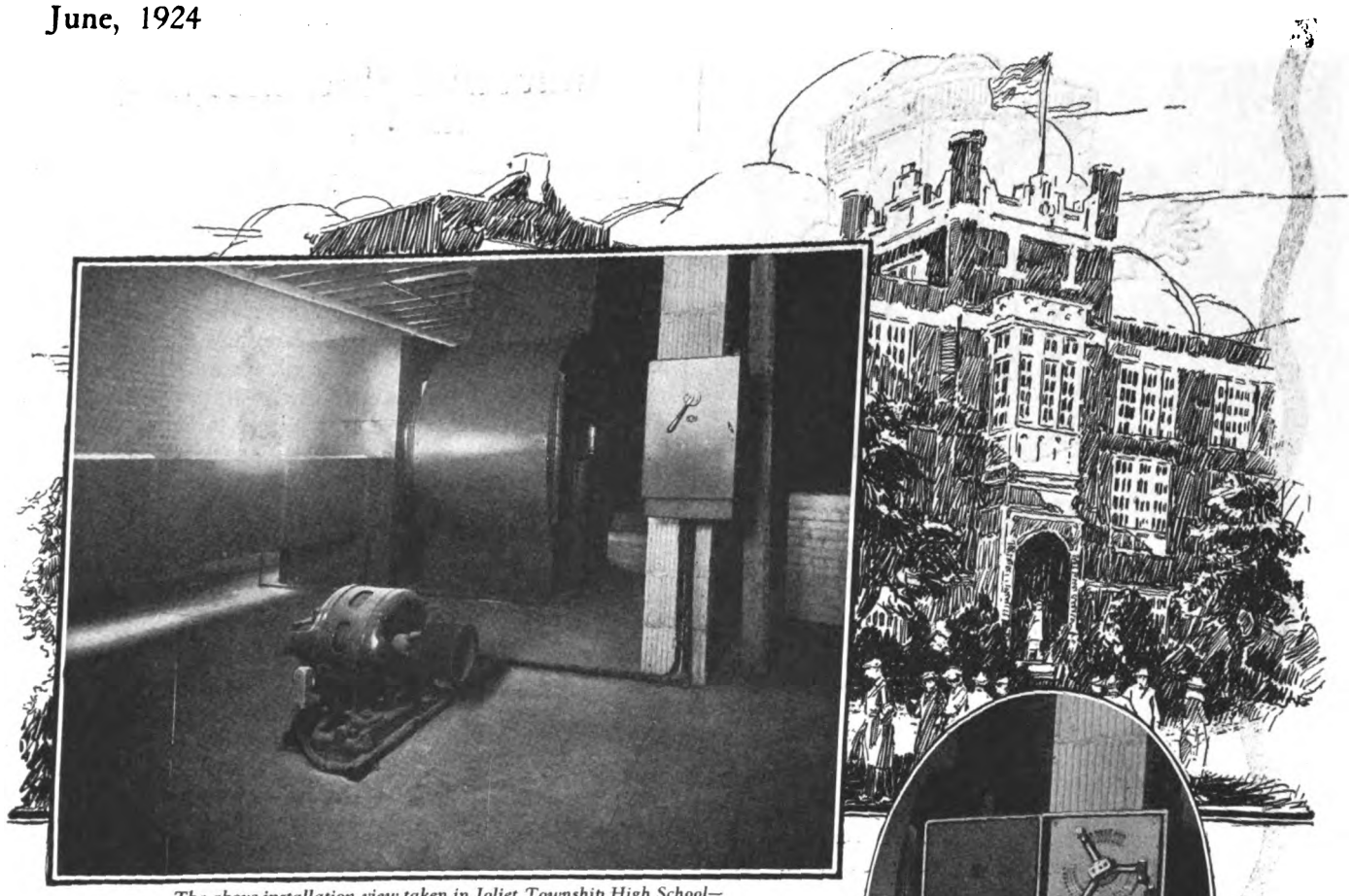
But there is one furnace lining that is jointless—Plibrico. It is installed in plastic form, modeled like clay to conform to all furnace shapes, easily pounded into shape by inexperienced workmen. Then it is vitrified by slow heat to form a rock-like lining that withstands temperatures to 3100 degrees F. and outlasts ordinary linings two to four times. The story of better furnace linings, "Refractories and Furnace Design," is yours for the asking.

Plibrico is delivered only in red steel containers of distinctive appearance as shown opposite. Warehouse stock in over 80 cities—see 'phone books.

PLIBRICO
FURNACE LINING
Reg. U. S. Pat. Off.
JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

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The above installation view taken in Joliet Township High School—
D. H. Burnham & Co., Architects

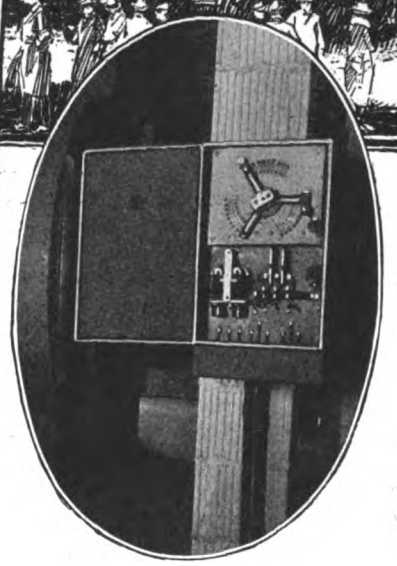
For School Buildings

Cutler-Hammer Building Equipment Type Controllers are particularly well suited for use with motor-driven ventilating systems and pumps installed in schools, institutions, office buildings, theaters, hospitals, and hotels.

Instead of ordering controllers for such purposes as special, the architect, engineer and contractor can now select the proper type from the standardized line developed by the C-H engineers.

These Controllers conform with the latest requirements of architects and engineers, the National Electrical Safety Code, Municipal and State Codes, and the Electric Power Club regulations.

The complete data on starting and speed regulating controllers are contained in our booklet, "Electric Control Specifications for Building Equipment."



This close-up view shows the location of starting, regulating and protective overload parts. The starting and regulating handles may be operated without opening the door of the safety enclosing cabinet.



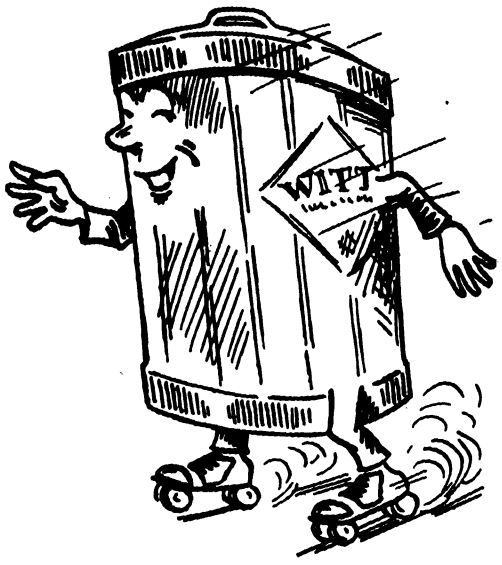
Our booklet, "Electric Control Specifications for Building Equipment," will be forwarded to architects and engineers on request.

THE CUTLER-HAMMER MFG. CO.
Motor Control Department
Works: MILWAUKEE *and* NEW YORK
Offices and Agents in Principal Cities
Northern Electric Co., Ltd., Canada

C-H ENCLOSED CONTROLLERS
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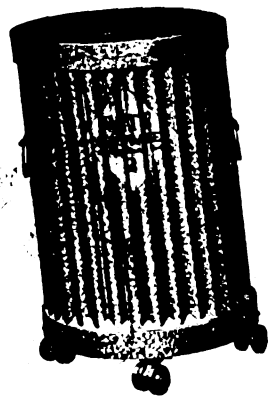
"Just a push and my 'rollers' take me from here to there in no time!"

Factories and Industrial Plants will find the new WITT Corrugated Roller Can a time and labor saver. Flexible Casters carry it quickly and easily over even or uneven floors.

The same remarkable and economical durability found in all

WITT CORRUGATED CANS — PAILS

is built into the new WITT Corrugated Roller Can. The addition of four double roller stem-type casters, held secure by cotter pins in malleable iron caster supports, riveted to the bottom band of a standard WITT Can, gives greater ease of handling. You will find by using the WITT Roller Can in the handling of liquids, small parts, etc., that your production has been speeded up and your overhead cut down.



If your mill supply house cannot supply you, write or wire us your requirements. There is a type and size of WITT for every need.

The WITT CORNICE CO.
CINCINNATI. OHIO.
THE YELLOW LABEL MEANS "QUALITY"

Industrial Housekeeping

(*Continued from page 27*)

cause lack of cleaning often causes a shutdown of important machines.

Plant sanitation covers a great many subjects not usually associated with the word cleaning. When the policy of the organization is definitely committed to real plant sanitation and backs it up with supervision of the right kind, enormous strides can be made, and cleanliness and sanitation become a very real influence and factor in the quality as well as the quantity of the output of the plant. Usual cleaning methods are confined to what might be termed corrective methods but with a broad policy it is possible to introduce preventive methods which are apt to be more important than the other.

Sweeping is usually given very little or no consideration. It is just one of those things which must be done every so often and it doesn't make much difference how, because tomorrow or next week it will be just as dirty again anyhow. However, when a little study is given to this subject the best method for each individual plant can be worked out. There are three methods in common use. First, the gang method in which a leader and a gang of sweepers clean a department either during or after working hours. Second, the method using one or more porters in each department who constantly clean up all day long. Third, a combination of the first and second methods whereby the regular porter takes care of certain work and the gang makes periodical thorough clean-ups.

The small details such as the type of brooms and brushes used have an important influence on the cost of cleaning as well as the manner in which it is done. Rough factory floors on which there are heavy chips or other materials require stiff brooms so that they will not bend and allow the chips to remain behind. In sweeping dusty floors some sweeping compound should be used in order to keep down the dust. This is especially important if cleaning is done during working hours. There are on the market a good many compounds for this purpose but if nothing better is available sawdust, wet down with water or sprinkled with oil makes a good dust catcher. Many floors keep dusting, due to wearing of the floor itself. This is often true of improperly laid concrete floors. These floors should be hardened, painted or oiled to overcome this condition. For yard and pavement sweeping, brush brooms are usually used as this cleaning need not be so well done. Sweeping is often done by contract with the men, a price per square foot for the various departments being agreed upon after timing the work. When this method is used the care used in cleaning out-of-the-way places should be checked up, as the tendency is to get the job done quickly and as easily as possible.

Scrubbing of floors is a part of the cleaning operation that has been greatly improved with the coming of the electric floor scrubbing machine. With hand methods, stiff house brooms are usually used with a good cleaning compound that will cut the oil and grease. When done on Saturday afternoons, a good sized gang is usually used with moppers following the scrubbers. A regular schedule of scrubbing should be decided on and strictly adhered to if floors are to be maintained in good condition. Electric scrubbing and mopping machines do the

(*Continued on page 76*)

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Check the Summer Drop in Production with "Ebco" Fountains

Now is the time to prepare for the summer heat by installing "Ebco" ice cooler drinking fountains at convenient places in your plant.

"Ebco" fountains will combat the depression in the production curve when the hot sultry summer days arrive.

Choose "Ebco" fountains, because they are remarkably low in price, are well insulated, sturdy in construction and unusually conserving in ice.

Drop a line to the nearest branch representative for catalog and prices. Do it now!

The D. A. Ebinger Sanitary Mfg. Co.
184 Lucas St. Columbus, Ohio

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Straight from the Shoulder

—Haiss—
Roller Bearing Rollers
Grease Packed Rollers
Strong Truss Frame
4 ply Rubber Belt
Adjustable Foot Pulley
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Patented Side Guards
Reliable Power
Reasonable Price

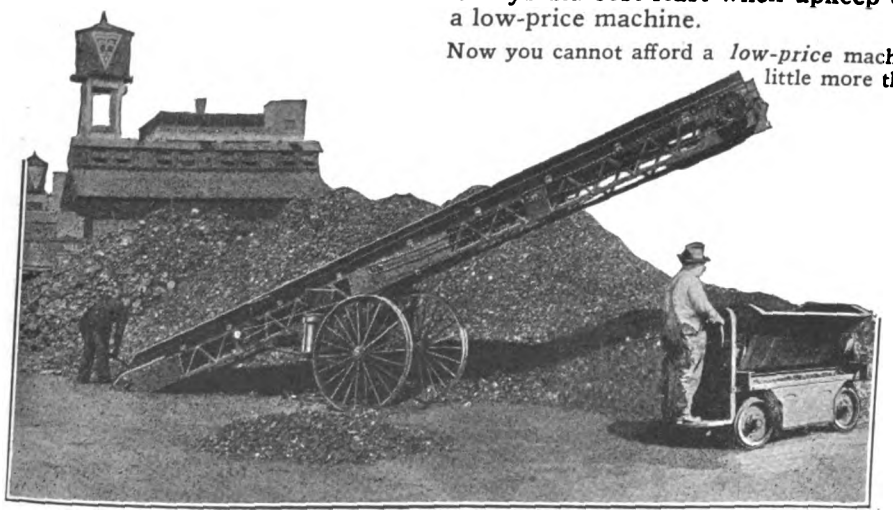
You can now buy

HAISS PORTABLE BELT CONVEYORS

for less than ever before

1924 is going to be a Haiss Belt Conveyor year. We are building only Haiss quality machines, but on a quantity basis that brings costs way down. And remember first cost isn't the only thing. Haiss Conveyors always did cost least when upkeep charges were added to the cost of a low-price machine.

Now you cannot afford a *low-price* machine—a Haiss is so good and costs so little more that there's nothing to it.



Let us quote you on a 1924 Haiss Portable Belt Conveyor—or ask for Bulletin 1022.

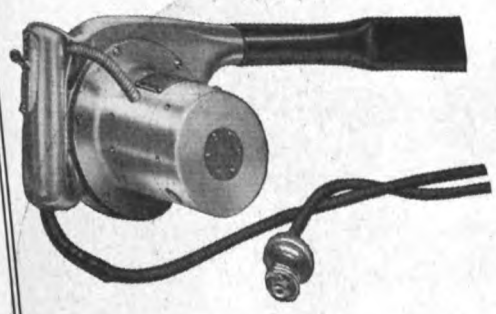
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Ball Bearing Portable Blower



6½ lb. Air Cooled BALL BEARING Motor

$40.00 Net

This "MARVEL" Portable Blower is designed for blowing dust and dirt out of MOTORS, GENERATORS, SWITCH BOARDS, LOOMS, KNITTING and other TEXTILE MACHINERY, as well for GAS BLOW PIPES, GAS FURNACES, ETC. Has 20 feet high grade cable and armored plug. Perfectly balanced. Has TOGGLE SWITCH in handle, operated by thumb. Gives 16" water column pressure.

Note the Metal Conduit carrying wires from motor to handle.

Motor operates at 10,000 R.P.M. on New Departure BALL BEARINGS. This Blower is a great time and labor saver, and its mechanical and electrical design gives assurance of a very long life, with a minimum of attention.

Made with UNIVERSAL motors (A.C. & D.C.) for both 110 volt and 220 volts. SHIPPING WEIGHT 18 lbs. Shipped on 10 days' trial, ANYWHERE.



Shipped on 10 Days Free Trial.

MANUFACTURED BY

ELECTRIC BLOWER COMPANY

352 Atlantic Avenue
Boston 9, Mass., U. S. A.



Cleaner Plant ---More Work

It's remarkable, how a clean, well-lighted, well-ventilated plant will actually increase production capacity, and better the grade of work turned out.

We can help a lot toward keeping yours *clean*. The rugged construction, the perfect balance, the extra-wide sweeping tip, and the tough bamboo core of Lay Metal Case Brooms make them ideal for general factory use.

There's a Lay Broom designed especially for your particular sweeping need.

Let us send you one for examination and trial. It's guaranteed, and we'll pay all carrying charges. What kind of a floor do you have?

The Joseph Lay Company
120 College Street
RIDGEVILLE INDIANA

"They hold their shape till worn to a stub"

(*Continued from page 74*)

work of several men at small expense and where there is a great deal of scrubbing to be done they are a good investment. These machines are great labor savers and they are bound to be used often because of the small expense and they therefore tend to bring about a cleaner plant. As a long cable is necessary to reach all parts of a room, a reel with an automatic winding device should be on each scrubber so that the cable will be kept out of the water and out of the way. The floors in the plant are usually of concrete, wood or composition. In toilet rooms they are frequently tile. This may be easily kept clean and is sanitary and vermin proof.

Oily floors require special cleaning compounds that will quickly remove the oil and grease and grime. The use of the correct compound for the individual job will usually save time and expense and it is good policy to call in experts in this line if the results are not commensurate with the time and money expended.

Vacuum cleaning has replaced sweeping in a great many plants. With a portable electric driven cleaner, no fixed piping is necessary and the cleaner may be wheeled all over the plant. Cleaning may be done during working hours without raising any dust and this fact alone is often a sufficient reason for the installation of this equipment. New plants may be piped up with outlets conveniently located and with a stationary cleaner in the basement. Such an installation is ideal. It is usual to use this system for cleaning dust from machines or equipment that could not otherwise be cleaned. Dust constitutes a serious fire hazard, which can, and should, be very greatly reduced.

Washing windows on the outside of buildings with steel sash usually necessitates some kind of staging. A small staging that may be hooked over the edge of the sash is the easiest way to handle this. The staging should be light so as to be easy to move from one window to the other and at the same time it should be strong enough to support a man. It is best to have a safety railing on the outside of the staging. Dirty windows and skylights cost money every day because it is necessary to light up earlier than would be necessary if the windows were clean. Cleaning windows therefore pays for itself. Only the south, east and west sides of a building get sunlight, the north side gets daylight which is diffused by the sky. This is excellent light as it is not necessary to draw shades and the room is lighted better farther away from the windows. With artificial lighting we usually have from five to fifteen foot-candles illumination whereas with daylight we have a great many times this intensity. The bright summer sunlight gives an intensity of about ten thousand foot-candles so it can easily be understood that daylight should be used whenever possible. The higher intensity of illumination during the day naturally allows the men to work faster and produce more so it is important that daylight be used as long as possible in order to speed up production. Insurance records indicate that more accidents occur during the winter months and when artificial lighting is in effect, so by keeping windows and skylights clean, accidents will be lowered.

Glass areas are expensive to install and they should be kept clean to make the investment profitable. A regular schedule of cleaning and a certain gang of men for this work is the only effective way of maintaining the

(*Continued on page 79*)

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What do You Waste?

NOT geographical location and climatic conditions, but the type of heating system employed, is what the Jenckes Organization found to be the controlling factor in fuel costs (see letter below).

This big textile firm did what every manufacturer and building owner should do—determined to find out what method of heating would prove most economical under the conditions peculiar to their own individual plants. They demanded specific figures—both on first cost and operating costs— on various types of heating systems.

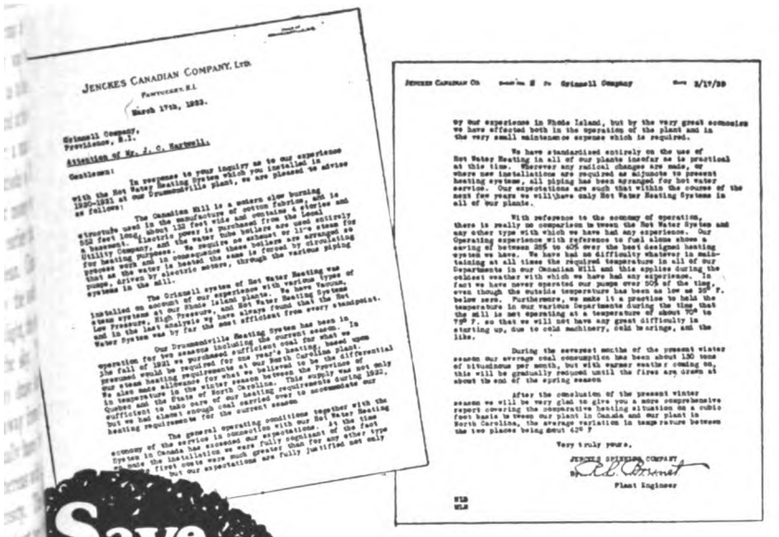
In this case a forced circulation hot water system cost more than steam. But this is not always true. Sometimes hot water systems cost less, sometimes more, to install than steam systems. But they save so much in fuel that any difference in first cost is soon returned many fold.

Yet the majority of manufacturers and building owners let contracts for heating systems without even inquiring into hot water's cost. They consequently never find out about the operating economy of such systems. The result is wasteful steam systems.

With any steam system you must spend good money for tons on tons of coal to produce extra heat *which is not needed.* Consider! The mean temperature for the winter months in five Northern cities is approximately 40°. At this temperature buildings can be heated to 68° by sending water into a properly engineered hot water system at 145° to 155°. Not more than once or twice a season must water be heated to 212°. But every day with a steam system you must raise 212°— enough to produce steam—or you get no heat.

Hot water gives the right amount of heat—no more. It gives this exact heat when the outside temperature calls for it—not before or after. You don't have to feed it excess fuel to give excess heat.

How much coal does steam heat waste for you?


JENCKES CANADIAN COMPANY, Ltd.

Pawtucket, R.I.

March 17th, 1922.

Grinnell Company,
Providence, R.I.

Attention of Mr. J. C. Farwell.

Gentlemen:

With the Hot Water Heating System which you installed in 1920-1921 at our Drummondville plant, we are pleased to advise as follows:

The Canadian Mill is a modern yarn burning plant, and consists of cotton fabric weaving and finishing mill.

The principal product of the Canadian Mill is a fine and extremely used in the manufacture of cotton fabrics, and is about 120 feet long. Current for this building is purchased from the Shawinigan Electric Power Co. and the water for exhaust or live steam for heating purposes is supplied by the Drummondville Water & Power Co. As regards the water supply, the conditions are such that we are forced to circulate the water in the mill. Driven by electric motors, through the various piping systems in the mill.

The Grinnell system of Hot Water Heating was installed on account of our experience with various types of steam systems in our Rhode Island Mills, and that the Hot Water Heating System was the most efficient from every standpoint. Low pressure, high pressure, vapor, vacuum, etc., have been tried by us, and in the end the Hot Water System was found to be the most economical.

Our Drummondville Heating System has been in operation for two seasons including the current season, and the fall of 1921 we purchased sufficient heating power from the Shawinigan Power Co. to operate our heating system, and the Drummondville plant is now entirely electrically operated. The differential in steam heating allowance for winter months and the difference in temperature in the Province of Quebec and the State of North Carolina, necessitate during the winter months the use of our heating system to accommodate our operatives, who have been accustomed to a certain temperature in the mills, and we have found that we have not been able to take enough coal during the past season to supply sufficient heat to keep the mills at the proper temperature for the heating requirements for that season.

The general operating conditions together with the economy of our heating system, as compared with the fuel system in Canada has exceeded our expectations. As the fuel system in Canada has exceeded our expectations. As the fuel problem in the Canadian Provinces is much greater than in the States, the first costs were much greater than for any other type of heating system, but our expectations are fully justified not only

Grinnell Company Providence, R.I. 3/17/22

by our experience in Rhode Island, but by the very great economies we have effected both in the operation of the plant and in the very small maintenance expense which is required.

We have standardized entirely on the use of Hot Water Heating in all of our plants insofar as is practical at this time. Wherever any radical changes are made, or where new installations are required we endeavor to present heating systems, all piping has been arranged for hot water service. Our expectations are such that within the course of the next few years we will have only Hot Water Heating Systems in all of our plants.

With reference to the economy of operation, there is really no comparison between the Hot Water System and any other type with which we have had any experience. Our Operating experience with reference to fuel alone shows a saving of between 20% to 40% over the best designed heating system we have. We have had no difficulty whatever in maintaining at all times the required temperature in all of our departments in our Canadian Mill and this applies during the coldest weather with which we have had any experience. In fact we have never operated our pumps over 50% of the time, even though the outside temperature has been as low as 20° F. below zero. Furthermore, we make it a practice to hold the temperature in our various departments during the time that the mill is not operating at a temperature of about 70° to 75° F. so that we will not have any great difficulty in starting up, due to cold machinery, cold bearings, and the like.

During the severest months of the present winter season our average coal consumption has been about 130 tons of bituminous per month, but with warmer weather coming on, this will be gradually reduced until the fires are drawn at about the end of the spring season.

After the conclusion of the present winter season we will be very glad to give you a more comprehensive report covering the comparative heating situation on a cubic foot basis between our plant in Canada and our plant in North Carolina, the average variation in temperature between the two places being about 40° F.

Very truly yours,

JENCKES SPINNING COMPANY

By H. C. Grinnell

Plant Engineer

HERE you have in general terms the advantages of hot water heating. But in the last analysis these advantages are governed by the engineering skill with which the system is planned and installed.

For more than seventy years Grinnell Company, Inc., has specialized in industrial heating and piping. Grinnell Engineers are fully equipped to cooperate with you and your consulting engineer or architect to eliminate waste from your heating costs. Our construction organization is through long experience able to translate the plans of a hot water system into a proper working equipment fully guaranteed.

If you want the truth about heating write us. Grinnell Company, Inc., 306 W. Exchange St., Providence, R. I.

Save 20 to 50% your coal bill.

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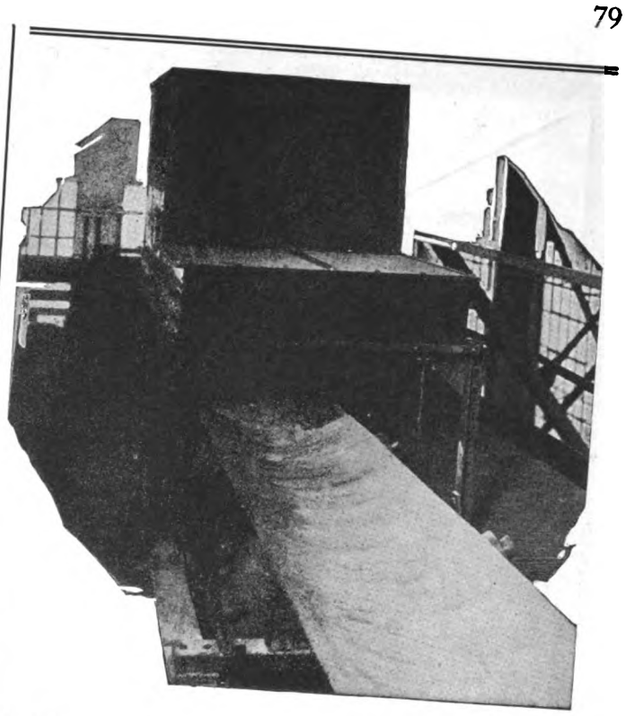
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(Continued from page 76)

windows and skylights in good condition. There is a certain cheerfulness about well cleaned windows that reflects on the tone of the men and makes them contented. On the other hand, dirty windows depress the men besides giving them poor light. With the window cleaning compounds now on the market it is an easy matter to clean windows compared with the older methods, and winter cleaning is now possible. The average cost of cleaning windows is from three-quarters of a cent to one cent a square foot, including material and labor. Surely no one can afford to do without clean windows. In factories where the sun beats in and there are no shades, some provision must be made to reduce the glare. There are on the market several coatings for taking care of this. This coating should keep out the glare but let in the light. It will naturally reduce the light a little but it will also diffuse it.

The lamps and reflectors of the lighting system must be regularly cleaned in order to keep the lighting up to standard. It is best to have a group of men trained in this work to take care of it all over the plant. They will soon get adept at handling this work and the cost will be reduced. The cost of cleaning the large steel reflectors and lamps averages about five cents, this cost being dependent on the frequency of cleanings and the class of work done in the department being cleaned. Even in so-called clean assembling rooms there is a great deal of dust and grime that settles on the fixtures, and in dusty departments, the accumulation on the lamps and reflectors quickly causes a large loss of electric energy. The frequency of cleanings is a matter to be individually decided but it is best to be on the safe side and clean too often rather than not often enough, because by keeping lighting up to standard, production will be kept uniform. It is possible to figure out the most economical period of cleaning any group of lighting units by taking into consideration the cost of power, cost of cleaning, the loss of light due to dirt accumulation and the number of hours per day that lights are burned. With average conditions the fixtures in a clean assembling department should be wiped out every three weeks and washed every three months. In other departments the cleaning should be more often, depending on the amount of dust and dirt in the room. In dusty and smoky places like foundries the fixtures need washing every week. For dry dirt, fixtures may be wiped with a dry cloth, then with damp one, and then dried with a dry cloth. When fixtures are washed, a good cleaning compound or soap and water should be used. If soap is used it should be thoroughly rinsed off, as dust sticks to a soapy film very quickly.

The cleanliness of toilet rooms has a very important influence on the health of the workers and it is therefore good policy to see that this work is thoroughly done. In large plants an inspector is often required to check up on the work of the cleaners. Closets are now made of all porcelain, without seats, for factory use but many object to them. However, if seats are installed they should be sanitary and waterproof. Quite a difference of opinion exists regarding the relative advantages of flush tanks or flush valves but if the pressure of the water is constant and reasonably high the flush valve is best because the workmen cannot tamper with it. Simplicity of working parts exposed to tampering is the aim of manufacturers of this kind of equipment.



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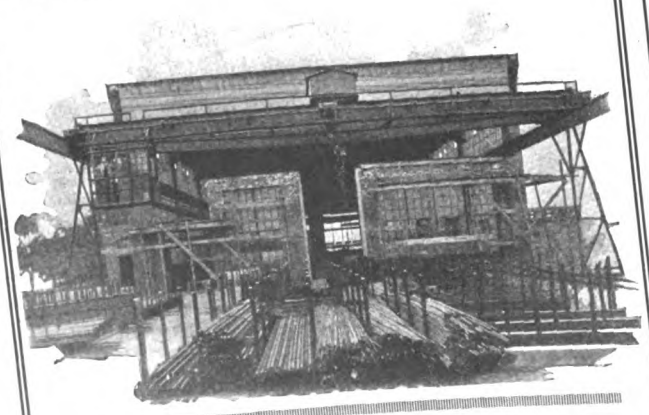
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The high stall urinal has pretty nearly rendered obsolete the old small urinal with which it was necessary to have slate or marble panels. On the high stall urinals the flush valve is most always used. Both closets and urinals should have daily cleaning with a disinfectant solution to be safe. If possible to do so, all closets should be ventilated at the rear of the fixture, but if this is not possible a ventilating stack or exhaust fan should be installed.

Partitions between toilets in the plant should be of steel or slate so that they can be washed down. They should be raised from the floor about a foot so that the floor may be easily scrubbed or washed. On account of its greater durability the steel toilet partition is gradually becoming universal and when it is enameled or painted it is very desirable from the sanitary standpoint. Glazed tiles on toilet room walls are easily cleaned with soap and water and they may be rinsed with hot water or washed with a hose. Tile floors should be scrubbed with a scouring powder and then mopped to get the accumulated dirt off the floor and then they should be rinsed with clean water, preferably hot water. This will leave tile floors clean and free from streaks.

Lockers and wash bowls are usually located as near each other as possible. Individual steel lockers and individual wash bowls make an ideal installation. This is often considered too expensive but it pays in the end by making the men feel that the management is interested in their comfort and welfare and it tends to make contented workmen. Steel lockers are sanitary and prevent the spread of disease germs, they also reduce the fire risk, as many men hang oily clothes in lockers. Where there is not enough room for single lockers, double tiers may be used, but in the winter the men dislike these because their overcoats will not hang straight in them. Individual wash bowls are quite expensive to install but health regulations are more and more insistent on having workmen wash in individual bowls or in clear running water in order to prevent the spread of disease. The old long double trough sinks that were filled with water before quitting time and in which all the men washed are very unsanitary. White enameled sinks may have a double row of faucets over the middle of the sink, allowing the use of running water but it must be seen to that the drain is not plugged up. Large, round sinks wherein the clean running water is thrown upwards like a fountain are very sanitary and because the men have no control over the amount or temperature of the water they are very good. An attendant turns on the water just before the men are ready to wash. In departments where the men get very dirty or perspire freely, shower baths should be provided. These should have mixing valves for regulating the temperature of the water.

Disinfectants should be used in water closets and urinals every day. A dilute solution used for cleaning them can be made to do double duty by flushing the traps with the solution left over after cleaning. A disinfectant that is at the same time a cleanser and a deodorant will have many advantages. In order to keep a plant so that health conditions are all right it is necessary to regularly use a good disinfectant, especially in toilet rooms and in the cleaning of cuspidors.

Many plants furnish soap and paper towels in office wash rooms but do not furnish either in the shop wash-

(*Continued on page* 82)

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Link-Belt's "Cub" Portable Loader

Cuts Handling Costs Over 47%

Handling costs reduced over 47%. Equipment paid for in 6 months, and now returning 197% net every year. Why not these economies in your work?

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Where formerly five or six men were needed to handle materials in a Chicago coal yard two men now do all the work. The wages of four men saved every day. And where once it cost 13c a ton to handle these materials, it now costs 5½c a ton. You, too, might be saving 7½c on every ton of material you handle.

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The advantages, however, are not all in labor savings. This conveyor moves one thousand pounds of material every minute—ten tons in twenty minutes. "Faster than any other loader" says the owner. The increased speed prompts orders, promotes good will, and keeps the wagons and trucks going on an even schedule.

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It is surprising how quickly the "Cub" pays for itself. This Company paid $600 for their "Cub" Conveyor (the present price is $485). In six months it had paid for itself. And ever since it has paid 197% in clear profit—actual cash pocketed each year.

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including 2 H.P., two or three phase, 60 cycle motor. It includes 21-ft. conveyor length. It includes a belt 18 inches wide that assures large capacity. Everything complete.

Compact, sturdy,—the "Cub" is built for hard service under the most exacting conditions.

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(*Continued from page* 80)

rooms. However, with the increasing use of piped up liquid soap many plants are furnishing this out in the shop. The men naturally prefer not to have to carry soap to and from their lockers and some plants have furnished bar soap out in the shop but as a rule this has not been found satisfactory. It is very unsanitary and after a man with dirty hands gets through using a cake of soap it is not very clean-looking for the next fellow. Powdered soap has been used in office washrooms for some time but like the glass liquid soap dispensers its use is usually confined to the office. The unsanitary practice of a number of people using the same soap apparently is not realized by many people else it would not be tolerated in public washrooms. Infections are easily carried from one person's hands to another and it is a good thing that plants have furnished no soap rather than subject the men to the chance of infection.

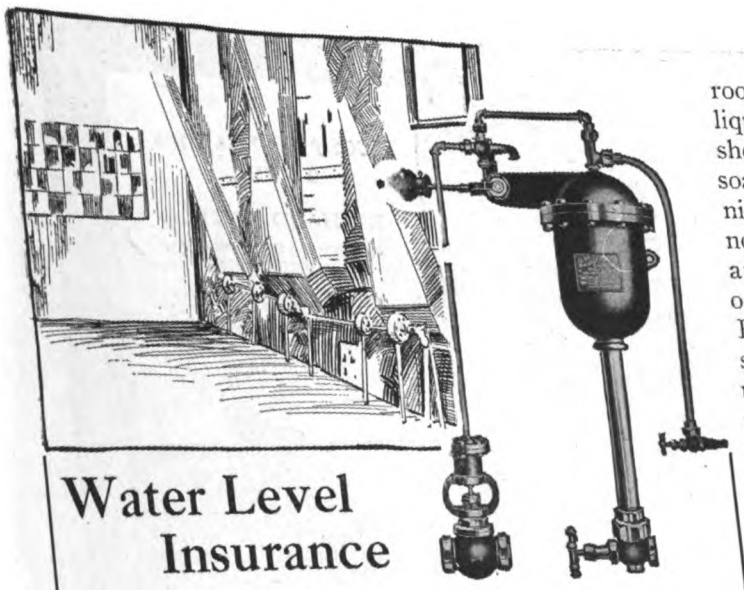


Wash fountains such as this are often adaptable, especially where space is limited.

The icing of bubblers is a job that should be well taken care of during the summer. The men should drink lots of water and if it is cold they will drink more. A truck specially built for this icing job should be lined with zinc or galvanized iron with a drain at the bottom controlled by a cock or a faucet. If city water is used it may be filtered if it is not up to standard. If the only water available is found to be not good for drinking by chemical analysis, some such method as artesian wells should be tried or else first class filters should be used.

Fireproof covered cans should be provided for rubbish such as garbage and waste paper so that the shop will be kept clean. With cans conveniently located, there is no reason for throwing rubbish around. These cans should be emptied every day; preferably after lunch. Each department that does machining work makes chips, and proper receptacles should be furnished for these. It is best to have cans or bins for each kind of chips or scrap made in each department and these should be cleaned out periodically. In cases where a large amount of chips are made on a machine in a day, such as on automatic screw machines, the chips should be removed in special trucks every day and taken to the oily chip separators or to the large bins for that particular kind of chips. Large bins may be hung on the outside of the building at about the third floor level and openings cut into the walls so that the different varieties of chips may be dumped into the bins. With hopper bottoms on these

(*Continued on page* 84)



Water Level Insurance

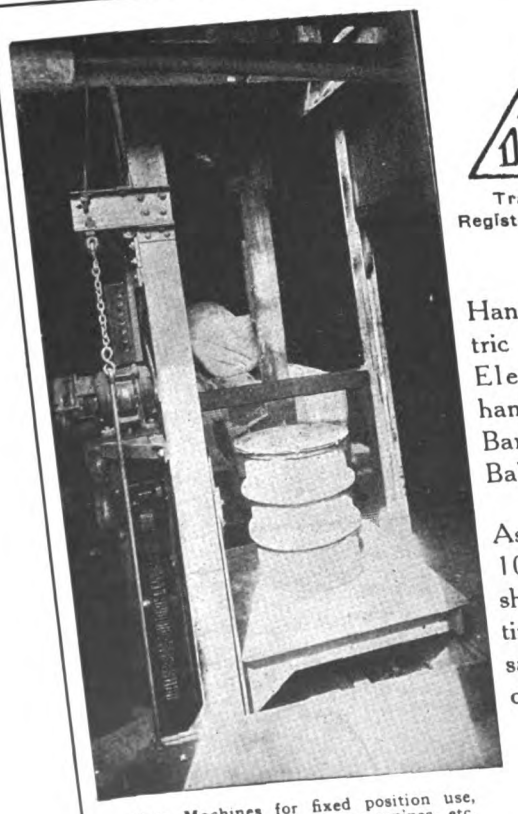
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MERCURY'S Honor Roll

It is an honor—which we freely acknowledge—to record so many of America's industrial leaders among the big users of Mercury tractors and trailers. The Mercury Trackless Train system, through more than 8 years of use, has earned its right to an important place in the daily operation of scores of big industrial and transportation companies throughout the world. It is only on the strength of this record that Mercury equipment has been added by such companies to the extent indicated below.

Every one of the 27 users in the list owns 10 or more Mercury tractors. Two have over 100 each in operation. Eight are using 50 or more. Eighteen have bought upward of 25 machines. The number of companies owning several Mercurys, but less than 10, is too great to list here.

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Illinois Central Railroad
American Ry. Express Co.
Chicago Union Station Co.
American Car & Foundry Co.
Eastman, Gardiner Lumber Co.
Chicago, Burlington & Quincy R. R.

It is highly significant that most of the above companies were confirmed users of Mercury tractors before the new Type H was perfected. This recently announced model with the internal gear drive offers economies of 25 to 35% in power consumption over the conventional worm driven machine. If you are not already fully informed on this important development, you will find our Bulletin No. 106 absorbing reading. Ask for a copy today.



Mercury Manu[illegible]ring Company

THE TRACKLESS TRAIN

4118 South Halsted Street — *Chicago, Illinois*

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(*Continued from page* 82)

bins it is an easy matter for an auto truck to back under the chute and get a load.

Waste paper should be quickly removed to a fireproof room for sorting and baling, or it should be removed from the plant every day as rubbish. With a baler it is usually possible to get quite a little more for the paper than the cost of the labor of baling, as this can be done by regular porters in spare time unless there is enough to keep a man or two busy. For any large quantities of paper, a motor driven steel baler is a good investment and is fireproof.

For cleaning oil off of machined parts the newer types of metal washing machines are superseding the old soda kettles where a man dipped a basketful of work up and down until it was clean. The larger machines have capacities of many tons of parts in a day and are a paying investment, as they need only attendants to feed work in and take it away after it has been cleaned.

Collections of oily chips should be made every day. Special trucks are a great help in this work and arrangements should be made so that the men can dump the truckload of oily chips directly into bins above the oil separators. On machines making quantities of oily chips, removable splash guards should be installed front and back to keep the floor clean. The machines usually have drip pans to catch the oily chips. Centrifugal oil separators are used for getting the oil out of the chips. In some cases steam is used to heat the chips in order to get more oil off them. In order to do this work economically proper arrangements should be made so that handling is cut to the minimum and that the oil flows by gravity when possible. After the oil has been removed by the centrifugals it should be filtered or clarified. When this is done the oil should be equal to new oil and may be delivered to the oil storage room or delivered to the machines. For this work a portable tank on wheels with a pump attached is economical, convenient and a great time saver. The amount of oil wasted in a plant in a year is surprising and every effort should be made to conserve it. Oily waste may be collected in special trucks and cleaned by steam and centrifugal separators and the oil reclaimed and the waste dried and used again.

In its broad sense, the work of the sanitation department safeguards the health of the men by keeping the whole plant in a sanitary condition. It also takes care of the cleaning of windows and artificial lighting units so that the men will have the best light possible. By keeping the floors and walls clean and attractive it makes the men more contented, and by keeping the buildings in good condition the depreciation is not so rapid. In order to be sure that all the work of this department is done well, some system of inspection is necessary. By having a monthly prize with frequent inspections as mentioned earlier in this article much can be accomplished. The assistance of each foreman is necessary to get reports of dirty conditions anywhere in the plant, or of broken windows, toilets that do not flush, and other points that need constant maintenance.



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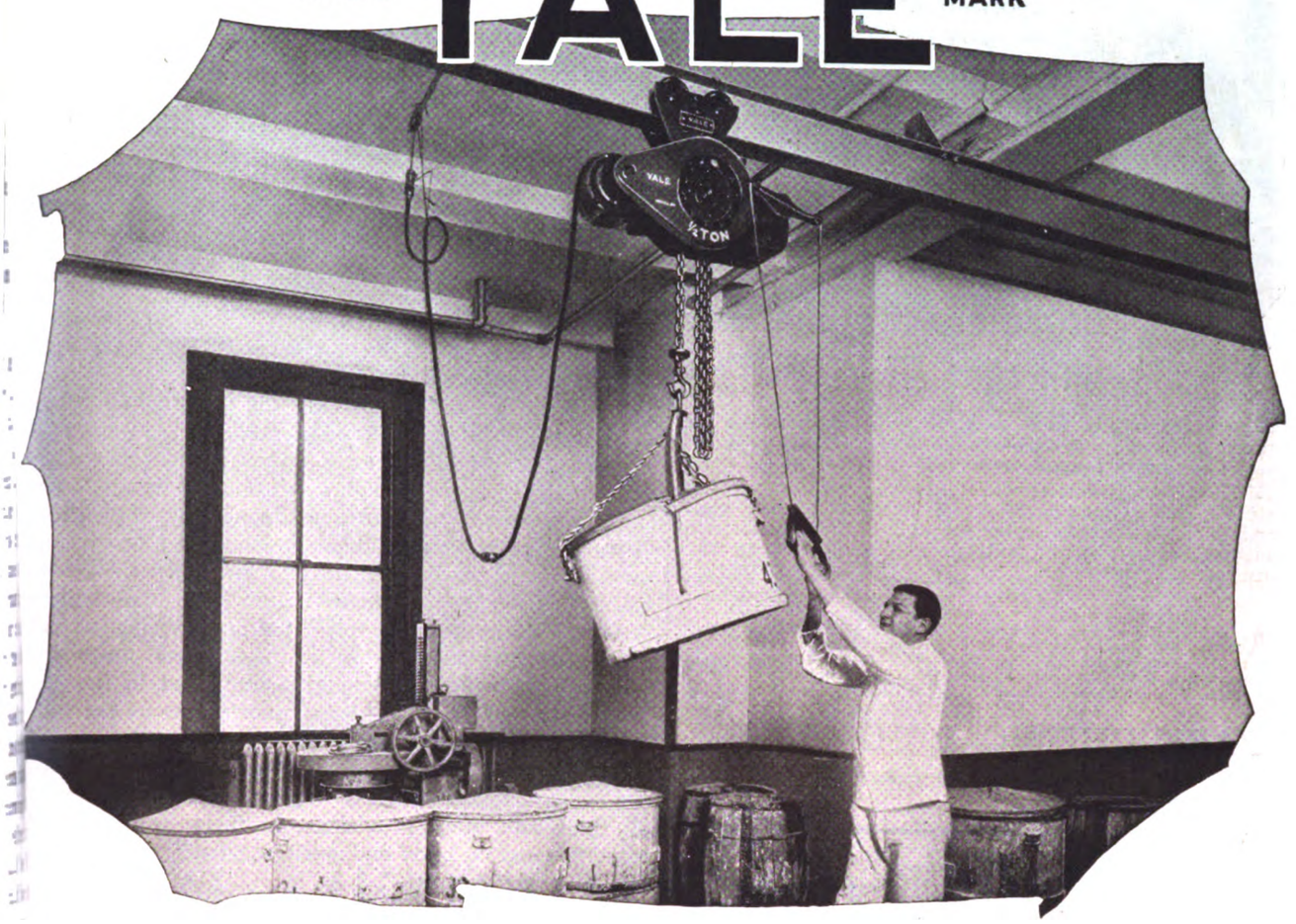
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The Yale Electric Hoist Connected to the Lighting Circuit

This Yale half-ton Electric Chain Hoist in the mixing room of a large pharmaceutical plant is plugged-in on the *single phase* lighting circuit.

With the Yale Steel-Plate Roller-Bearing Trolley and I-Beam track system it furnishes a highly economical, convenient and efficient method of handling the heavy pots of tooth paste from mixing machines to the packing hoppers.

The Yale Electric Hoist is the only chain hoist on the market adapted to single-phase current. These hoists are made in capacities of from ½-ton, quick speed, to 1-ton and 2-ton standard speed for use with either 110 or 220 volt, 60 cycle, lighting current. And the Yale line includes a hoist for every standard circuit, A.C. or D.C.

Upper and lower limit stops prevent overtravel of the load hook in either direction and the 50 per cent overload test, with the line of steel from hook to hook, assures safety under all working conditions.

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Eliminate the Shadows and that Glaring Heat

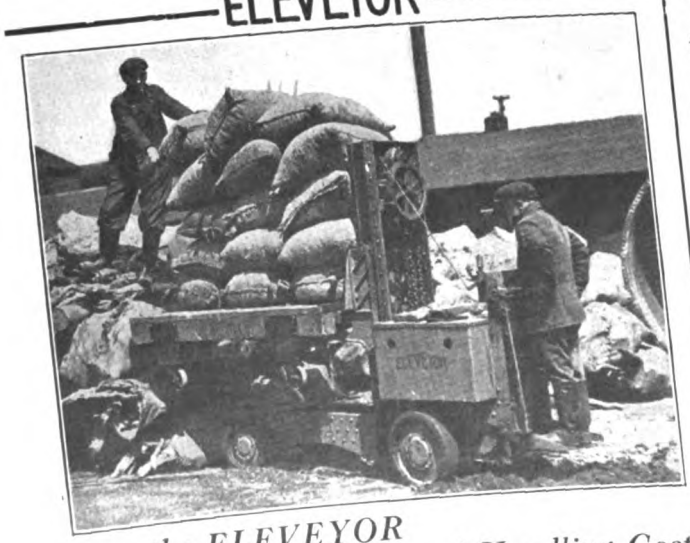
Did you ever stop to think what the production toll of the Summer sun costs you each year in decreased efficiency because of eye-strain, fatigue, deep shadows, and excessive heat? BLU-EE on the windows will diffuse the sun's rays to fill the plant all day long with a cool, pure-white, shadowless illumination. It is easily applied, costs but a fraction of what shades or awnings would, and can be readily removed with warm water.

OFFER

We will send you two packages of BLU-EE—enough to cover 2,000 Sq. Ft. Use one of them as a trial. If you're not satisfied with the result, return the other package at our expense. If you are satisfied, send us your check for $5.00 (discounts for quantity orders). You can't lose anything on it; the trial costs you nothing.

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Here the ELEVEYOR Saves 50% of Handling Costs



These are the exact figures at this plant (name on request.)

In the handling of 175 lb. bundles of merchandise the ELEVEYOR has reduced the cost to 4.2 cents per bundle—this includes all fixed charges, such as depreciation, repairs, cost of charging and charging outfit and insurance. The hand labor method was 8.6 cents per bundle.

We have many more such examples of economies effected by the ELEVEYOR. Let us tell you about them. *Write for Catalog*

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Export Repr.....International General Electric Co., Schenectady, N. Y.

Modern Ethics in European Factories

(*Continued from page* 31)

with accepted modern American industrial psychology.

Bournville village is an estate of 942 acres adjoining Birmingham, England. The freehold of the land is owned by the trust endowed by George Cadbury in 1901; the whole of the revenue is to be used for the erection of cottages, the purchase of additional land, and for the general improvement of housing and town-planning conditions. The area of the estate includes the property of Cadbury Bros., Ltd., but residence on the estate is not limited to employees of the firm. There are 1,077 houses and 5,500 inhabitants on the estate. In addition to the gardens there are 1,113 allotments.

The factory buildings housing the Cadbury chocolate manufacture and its subsidiary trades employ 10,000 people. The buildings were removed from Birmingham in 1879, and in their new location are designed not only to meet every requirement in the way of lighting, heating and ventilation but to be made as attractive as possible to the worker. In the words of Mr. Cadbury's associates: "The erection of the factory in a country district outside the large town, the preservation, as far as possible, of any natural features which make for beauty both inside the factory bounds and in its surroundings, such comparatively minor points as the hiding of bare brick wall by climbing plants, the use of decorative flowers and plants in dining and work rooms, the encouragement given to organized singing at work, all these and other provisions, in their elevating and refining effect on mind and spirit, inevitably react favorably on physical health."

Education and health have been among the strongest factors to build up the Cadburys' business. Two figures may be quoted as evidence of the latter: $\frac{7.7}{15.9}$ and $\frac{51}{97}$, which mean the ratio per thousand of the average death rate and of infant mortality in Bournville and in all England.

The blocks of buildings are separated from each other by streets, which not only enables the rooms to obtain a maximum of light and air, but also minimizes the danger in case of fire. Ventilation is carried out as far as possible by natural methods. The various rooms in the factory are periodically sprayed with an odorless disinfectant. There are dressing roms with facilities for drying wet clothes, and overshoes are supplied at low rates during wet or snowy weather.

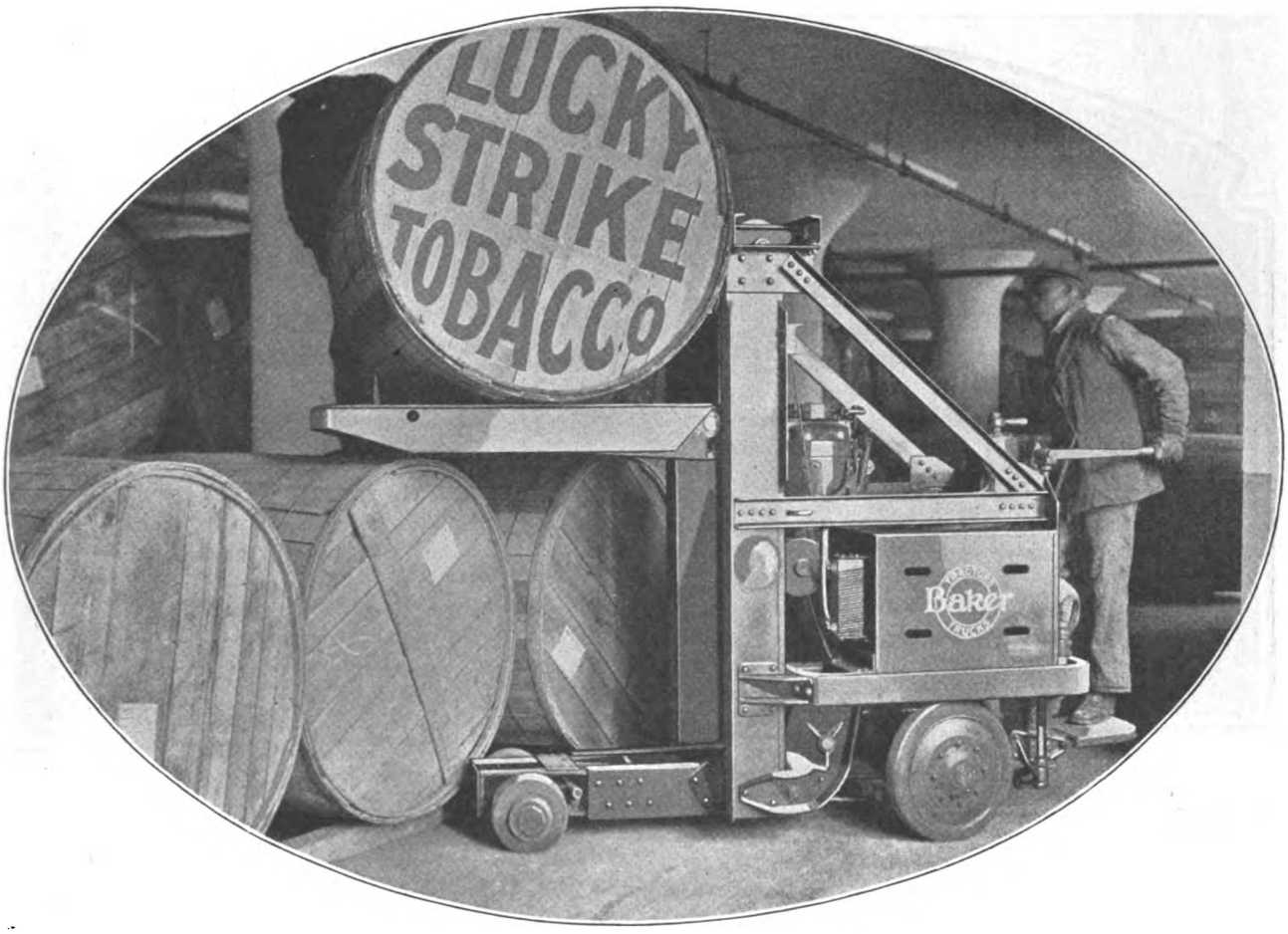
The hours worked in the factory are normally 44 per week, made up as follows: Monday to Friday, 7.45 a. m. to 12.30 p. m.; 1.30 p. m. to 5.00 p. m.; Saturday, 7.45 a. m. to 11.45 a. m. This gives a total of 45¼ hours, but on every fourth Friday work ceases at 4 p. m. and the following Saturday is a full holiday, thus adjusting the difference. When weights have to be systematically lifted or carried it was found that anything in excess of the following is liable to cause injury:

Boys under 15.....17 to 18 lbs.
Youths under 17.....24 to 30 lbs.
Men under twenty.....30 to 38 lbs.

and for weights in excess of the above specially selected

(*Continued on page* 89)

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Handling Costs Cut In Half

$125 Saved Every Week!

THAT'S the record of one Baker High-Lift Truck at the Brooklyn warehouse of the American Tobacco Co. Here are the actual figures on its performance.

Unloads hogsheads from freight cars,
releasing 2 men, at $50.00 weekly, for other work.

Stacks 1200 lb. hogsheads in warehouse,
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Loads commercial trucks from warehouse,
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You can raise 4000 lbs. through 6 ft. with the Baker Hi-Lift elevating platform truck, carry it away and then buck the load into position.

This warehousing model for use in cramped quarters is only one type of Baker industrial tractors and trucks. Our catalog describes them all.

Baker Industrial Division

THE BAKER R & L COMPANY CLEVELAND, OHIO.

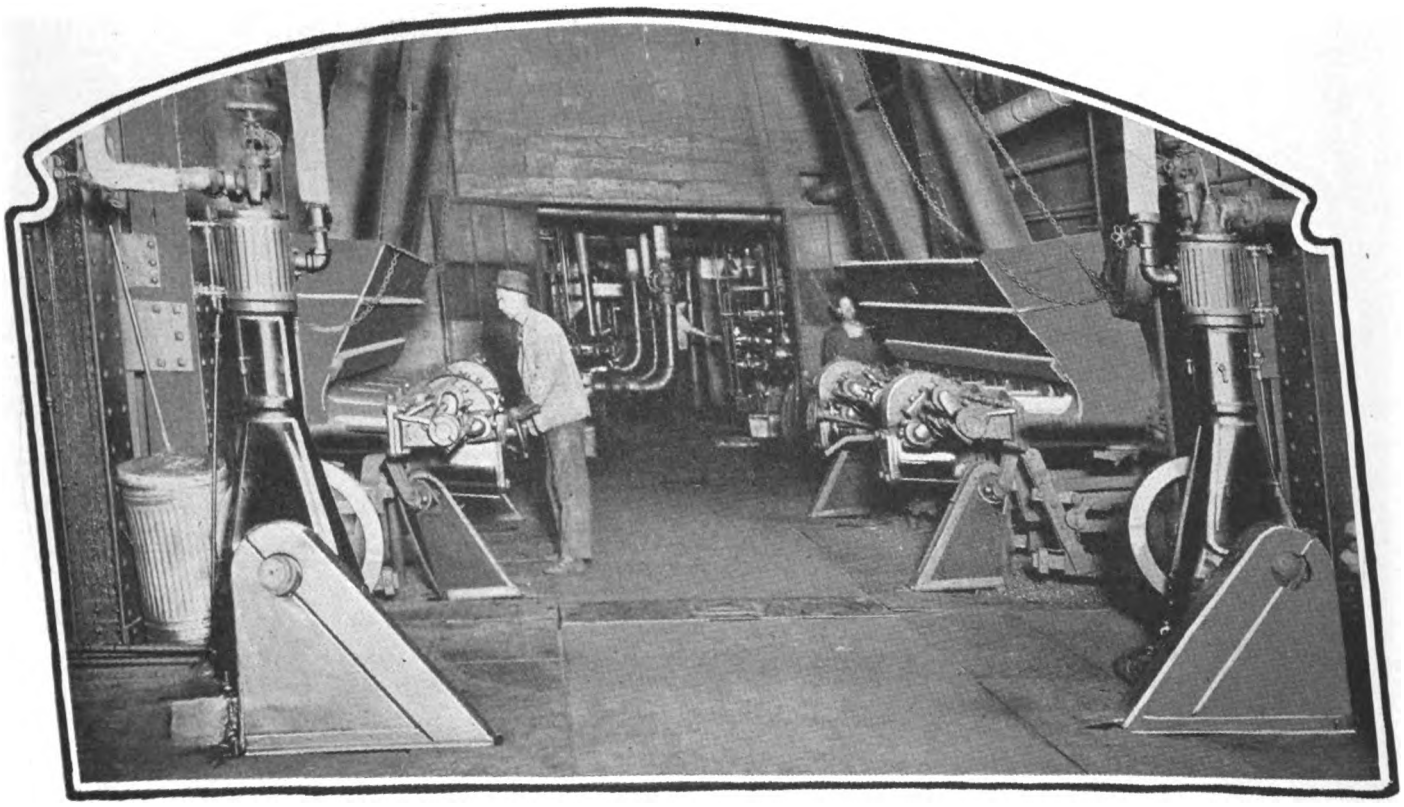
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Low Cost Dependable Power

That Troy Engines meet every requirement of the smaller as well as the larger plant is nowhere better shown than at the Lynch Coal Mine of the United States Steel Corporation, Lynch, Kentucky.

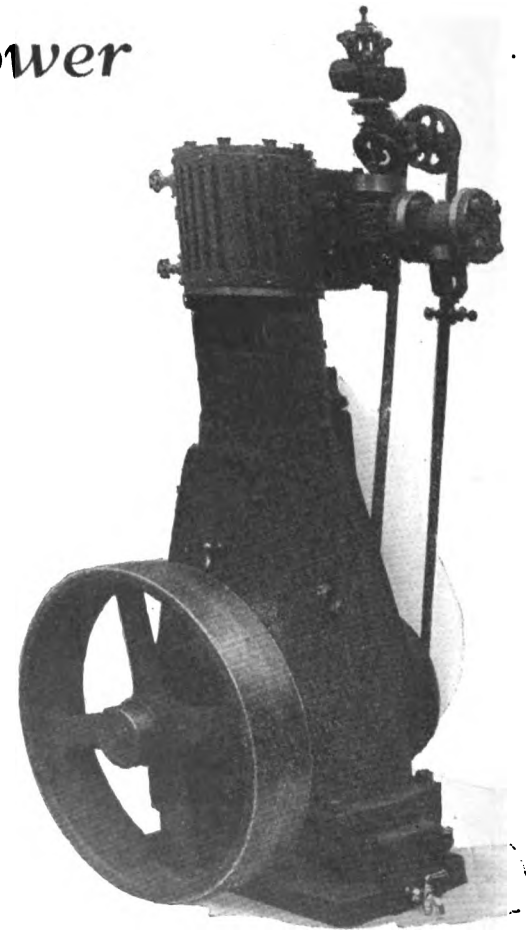
Here the two Troy Engines drive the stokers and more than pay for themselves in carrying the whole load at night, Sundays and off-peak periods.

Thus Troy Engines meet every requirement for highest efficiency in the smallest space.

The many Troy features make this possible—the rugged construction, compact and symmetrical—the self-oiling feature and the balanced valve which remains steam tight and sealed for years and avoids the expense of renewing bushings and valves. This balanced valve makes Troy Engines exceedingly safe under all working conditions because condensation is automatically cleared from the cylinder.

Troy units are designed for all industrial power requirements in capacities up to 200 B H P.

Write for the Troy Catalog.



TROY ENGINE & MACHINE CO.
TROY, PA.

TROY ENGINES

Dependable Power with Absolute Safety

When writing advertisers please mention Industry Illustrated

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(*Continued from page 86*)

men are appointed. For inefficient and slow workers there are special provisions in order to get the best out of them.

The medical service afforded the workers is extensive. There were 26 severe and 1,500 slight accidents, only one fatal during the past 14 years. Instructions are given that every accident, however slight, shall be immediately reported and prompt attention given. This stringency is reflected in these figures, the apparently great increase of minor accidents being an index of the number reported. If this precaution is not taken, the employee forfeits the company's supplementary gift for accidents. The majority of workrooms and offices are fitted with an ambulance box in definite charge of one or two members of the Works Ambulance (who possess St. John's Ambulance certificates) employed in that particular room. When any infectious diseases occur at the home of an employee he must not return to work, in the case of scarlet fever, diphtheria and membranous croup, for 8 days; mumps 21 days; other infectious diseases 14 days,—and until certified by a medical man to be free from infection, such certificate to be countersigned by the works doctor. These arrangements are an adequate contribution to the safety-first campaign; and their cost represents only four shillings per cent. of wages.

Especially remarkable is the institution of the works dentists. All applicants for work are examined by a works dentist as part of the preliminary medical examination. It is a condition of employment that all who enter the works under 18 years of age shall have what dental treatment is considered necessary. Toothbrushes and powder are given free to all entrants under 18 and sold at cost to the others.

There are many other institutions worth notice in that factory—the works councils, the educational facilities, the employees' recreations, the magnificent swimming baths, dining rooms, clubs, the benevolent funds, the Bournville Works magazine. These provisions added to the special features mentioned above make not only for a high standard of health but create a spirit of loyalty which I noticed through the village and works, a spirit built upon love.

The ethics of George Cadbury are given eloquent testimonial in the "memory lamps" lighted by his friends soon after his death. "To meet him," says Mr. Davenport, "was to step into a ray of sunshine, and to feel a glow of human kindliness beyond expression." Dr. Hodgkin says: "How many a man is a better man because George Cadbury dared to trust him! I think of George Cadbury as a man who loved, who had something that touched the common human chord. He cared about men and women. He felt with them." That is inspiring language when we are speaking of industrial ethics. George Cadbury saw things and developed action under a high angle of vision. His earthly journey ended like his daily life, "with a walk in the evening to the top of a hill."

The Hill—such is, precisely, the name of the London residence of Lord Leverhulme. And for the fifty years that William Hesketh Lever has been in business the rising of his fortune has been the just reward of the uninterrupted elevation of the man. To write about Port Sunlight, his soap works, his army of employees, his delightful garden village, would be only to dwell upon



Specify "STURDI" for Your Plant

—Just a "Lift-Truck" Won't Do!

Where aisles are narrow and loads heavy, STURDI-TRUCKS, with their superior "any angle" lift can always be operated in less space.

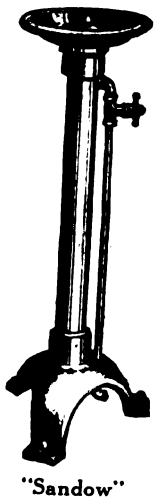
One man lifts—and pulls—5,000 lb. loads with ease. The exclusive SINGLE FRAME gives full 3 or 5 inch elevation. Powerful step-by-step lift. Write for catalog and price list.



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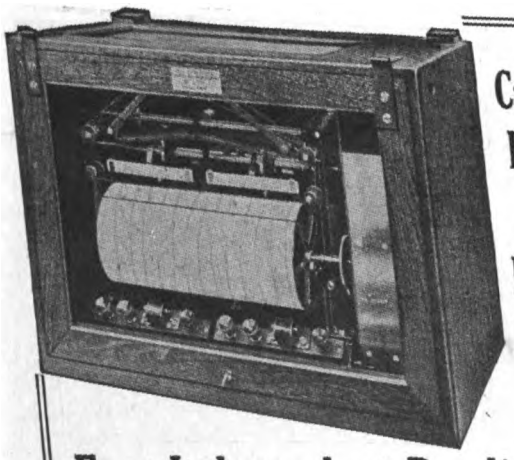
Real water devices made especially for hard service.
Practically everlasting in life and performance.

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Cambridge Electrical CO^2 Recorders Indicators

Four Independent Readings from Four Boilers on ONE Chart

are afforded by the Cambridge instrument shown above. This feature makes it the logical choice for the busy boiler room. By showing four CO2 percentages on one chart time is saved and the possibility of errors in reading is greatly reduced.

Cambridge Electrical CO2 Recorders and Indicators are extremely accurate and rapid in action and practically fool proof. They are entirely electrical —no chemicals to renew—no glass or rubber parts to break or wear out. These rugged instruments may be installed any distance from the flue. Maintenance cost is very low.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of INDUSTRY ILLUSTRATED, published monthly at New York, N. Y., for April 1, 1924.

STATE OF NEW YORK, COUNTY OF NEW YORK, } ss.

Before me, a Notary Public in and for the State and County aforesaid, personally appeared John H. Van Deventer, who, having been duly sworn according to law, deposes and says that he is the Editor of the INDUSTRY ILLUSTRATED, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, and business managers are:

Publisher, Engineering Magazine Co., 120 West 32d St., New York, N. Y.

Editor, John H. Van Deventer, 120 West 32d St., New York, N. Y.

Managing Editor, None.

Business Manager, Harvey Conover, Jr., 120 West 32d St., New York, N. Y.

2. That the owners are:

Engineering Magazine Co., 120 West 32d St., New York, N. Y.
John R. Dunlap, 120 West 32d St., New York, N. Y.
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Harvey Conover, Jr., 120 West 32d St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN H. VAN DEVENTER, Pres.

Sworn to and subscribed before me this 27th day of March, 1924.

JOSEPH A. BURLANDO.

(My Commission expires March 30, 1925.)

an old story. But to realize that the creative genius of the Soap King is not yet satisfied with the many institutions which make his factories an object lesson to students of social welfare and industrial management is worth consideration.

The great discovery of his Lordship's life was that basis of partnership best adapted to modern business. All the employees of Lever Bros. and of the associated companies are now entitled under certain conditions to certificates of co-partnership making them shareholders of the concern and partakers, as such, both of the gains and of the losses. Significant of success is what Lord Leverhulme had to say at the end of 1922 about his experiment: "The last two years of strain that we have gone through in business have proved that co-partnership is a sheet anchor in such a time, and that it is adversity that draws human hearts together and not prosperity. We all know it. You find your friends when you are in adversity; you do not know your friends when you are in prosperity. Co-partnership has come through the ordeal, and proves that it stands adversity."

The ethics of Lord Leverhulme are manifest in his last speech, where he shows the slow progress of human engineering as compared with that of science, and where he expounds his insurance scheme: "Science marches forward: we human elements have lagged behind. We have never adapted the human element in business to produce the best results. Science has made advances on Robert Fulton's first steamship, for we have the Mauretania, the Olympic, and others,—but in regard to schemes for humanity, no.

"We are living in better houses, living under better conditions, and with greater comfort, but in the line of relationships between each other we have not advanced much. Let us hope that before we solve the power of the atom we will have solved the mysteries of the power contained in every human breast."

Among the most representative English firms wherein applied industrial ethics are noteworthy, I shall briefly mention the following:

At the Crumpsall Works of the Wholesale Co-operative Society, George Brill, first director, gave forever his touch of brotherliness to his fellow working people. At the Irlam Works a tactful social secretary gives guidance to the employees.

Rowntree at York and Reckitts Blue at Hull are famous for their garden villages and for their kindly way of dealing with their employees.

The Spirella Works at Letchworth Garden City (England) erected by Mr. Kincaid, president of the Niagara Chamber of Commerce, are a monument both to the magnificence of American industrial architecture and to the gentle art of making girls, women and boys happy in their labor.

On the side of the workingmen, the Educational Alliance founded by Mandsbridge, the Adults' Schools, the Settlements, the Labor College (Ruskin College) at Oxford, and similar agencies are responsible for a moral and intellectual uplifting.

But whatever the developments of modern English industrial ethics, the whole edifice is more or less resting on cornerstones laid half a century ago by such men as Ruskin, William Morris, the seventh Earl of Shaftesbury. The industrial ethics of the Earl were quite revolutionary when he uttered them: "There is nothing so

(*Continued on page 92*)

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New model type "G" Cowan Hand Lift Truck

Originator of lift truck system brings out new model

THE new model type "G" Cowan Hand Lift Truck is built with either a narrow or broad frame and is furnished with either a single or double front wheel construction. A highly improved release check has been adopted which insures easy lowering of loads without shock or damage to loads or floors. These and many other excellent features make it a truck of superior merit.

Over 12,000 users must mean quality

THE fact that this business has been built up in a very few years from nothing, to one having 12,000 users, is excellent proof of the quality of Cowan Trucks and Skids, and of the value of the Cowan system of reducing handling costs. It would take more space than is available even to list the different *industries* in which it is used. Nevertheless, for your information, a few typical industries are listed here.

Paper
Woodworking
Packing
Laundry
Dairy
Machinery
Warehousing
Railroad
Textile
Electrical
Chemical
Pottery
Automobile
Tire
Confectionary

Saves $1200 a year with one Cowan Truck

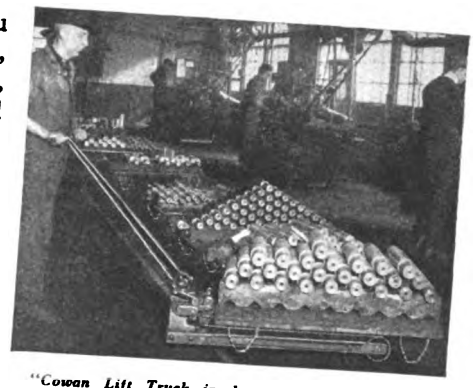
RESULT of installing Cowan System in plant of E. K. Jennings and Sons, New London, Ohio, indicates remarkable possibilities for others.

If you should go out to New London, Ohio, and step into the plant of E. K. Jennings and Sons, manufacturers of concrete blocks, you would see, in efficient operation, a single Cowan Hand Lift Truck, serving 15 skids. And they would tell you, if you inquired, that this equipment averaged to handle 12 tons of material per day, at the saving of one man, or ten hours, or $4.00. Figured roughly on a 300 day year basis, this represents a yearly saving of $1200, which is small compared to what the Cowan Plan and Survey often shows a manufacturer he can save.

Saves 40 to 60% of handling costs

COWAN equipment is not just merchandise, but a system of reducing handling costs through the elimination of unproductive labor. 40 to 60% of handling costs saved is not unusual. In actual figures this often mounts into the thousands of dollars, depending upon the size of the company, and the amount of material to be handled. It is just exactly so much more net profit. A manufacturer recently wrote us, "I have often said that this truck was worth its weight in gold to us in the handling of the new machinery in this mill and also the cotton from our receiving point into the storage warehouse."

The basis of the Cowan System is the "through-ticket skid," which may be compared to a movable section of floor space. The skid and the load which it supports may be picked up by the Cowan truck, carried to a new location and set down, without loading or unloading. As you know, there is an enormous amount of "carrying from here to there" in any manufacturing plant. The Cowan System eliminates the wasted labor of loading and unloading every time the "here to there" process occurs. This elimination soon mounts up into thousands of dollars saved.



"Cowan Lift Truck in large Elevator Manufacturing plant."

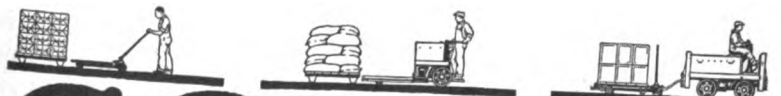
Plan and Survey

JUST what equipment a particular plant or factory needs is a matter to be determined by a complete survey. And that is the way we work. We make first, as engineers, a survey of your present handling methods and costs. Then we draw up a plan to show you exactly how the Cowan System should be installed to effect the greatest saving for you, and we estimate, pretty accurately, what that saving will be.

We make no charge for our plan and survey. We merely use it as the basis for a mutual agreement between us as to whether you will or will not install the Cowan System.

Send today for information

THOUSANDS of manufacturers are today making worth while savings, more net profits, with the Cowan System. What we have done for others, big and small, we can do for you. For complete information, without obligation, simply send us the coupon below. Cowan Truck Company, Dept. A-1, Holyoke, Mass.



COWAN
"TRANSVEYORS"
HAND AND ELECTRIC LIFT AND CARRY TRUCKS

COWAN TRUCK COMPANY
Dept. A-1, Holyoke, Mass.

Gentlemen: Please send complete information about the Cowan System of Reducing Handling Costs to:

Name of Company.....

Name of individual.....

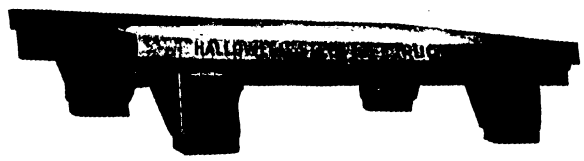
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City .....

We now use.....do not use.....lift trucks (please check). If convenient, please give some information about your handling conditions and problems.

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For ruggedness, strength, serviceability, and long life, specify the "Hallowell"

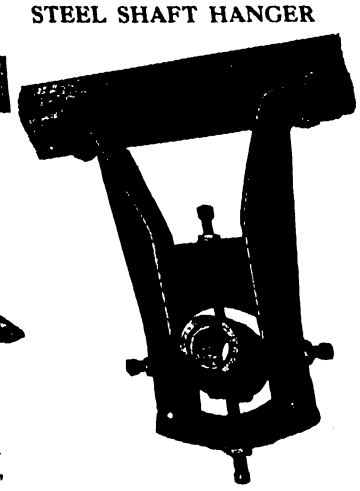
LOW INITIAL COST

"HALLOWELL" STEEL BENCH LEG



For strength, durability and rigidity use "Hallowell" Steel Bench Legs. They are rapidly replacing the old style all wood construction.

"PIONEER" STEEL SHAFT HANGER



"HALLOWELL" STEEL COLLAR



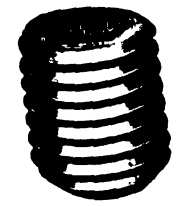
When ordering shaft hangers insist upon the "Pioneer." It's the original steel shaft hanger.

Don't make your own collars—use the "Hallowell"—it's superior and costs less.

"STANDCO" SOCKET HEAD CAP SCREW



"STANDCO" HOLLOW SET SCREW



"Standco" screws, both **Filister** and **Set**, are quality products. Samples gladly furnished upon request for tests and the results along with our prices will prove interesting.

Standard Pressed Steel Co.
Jenkintown, Pa.

(*Continued from page* 90)

economical as humanity. When men are contented, they become excessively reasonable, and employers and employees find their interests are identical."

But in the England of 1924 these principles are so self-evident that an Industrial Welfare Society has been created. According to an anecdote, the origin of the Society was the outcome of the presence of Lloyd George in a munition factory when a girl worker collapsed in front of him. Having heard that the girl, although severely ill, had not been excused from work, he thought there was a link lacking in the chain of industrial efficiency. He soon consulted Mr. Rountree on the establishment of a welfare department of the Ministry of Munitions, and Mr. Hyde, a London social worker of high repute, was put in charge of the new Department. The institution, surviving the war, became a private affair, and is now part of English industrial ethics. In a recent lecture Mr. Hyde said: "The industrial welfare movement aims at eliminating the fundamental causes of unrest and misery which by many were considered necessary evils of the industrial system. The old relationship between master and man has broken down, but this movement is attempting to restore them under modern conditions."

In France, progressive manufacturers have been and are influenced by various motives; but in the main I discover in the French industrial ethics of today, consciously or not, the spirit of association instilled nearly a century ago by that visionary of genius, Fourier, in his Theorie de l'Unité Universelle. The American student in Paris will be delighted, I am sure, to listen to the masterly lesson on Fourier and the spirit of association which is delivered each week at the College de France by Professor Charles Gide. Le Play, a pioneer in the science of human engineering, and his prominent follower, the late Professor Cheysson, are also underlying influences which are actually felt.

Typically French are the Familistère Works, which manufacture heating apparatus and general hardware. They were started at Guise by Godin, spiritul son of Fourier, in 1856, and destroyed at first by the Germans in 1871, a second time during the Great War, and rebuilt in 1923 by Mr. Colin.

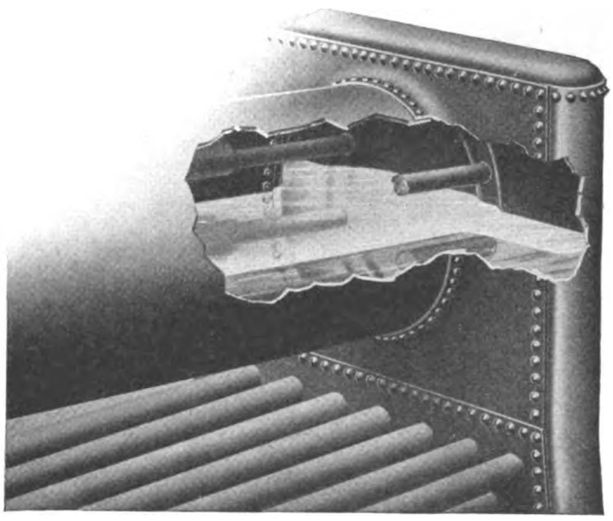
The continued success of these works is due to the close co-partnership existing, originally, between master and man, and, now, between the men who have won their title to the position of associates. In January, 1923, they had 1,700 employees, a great part of them being co-partners, and the whole force being insured against sickness and the lack of the necessities of life. The workers' co-partnership societies are federated under the leadership of that radiant gentleman, E. Briat. They have their special committee in both houses of parliament, and although their status is of minor importance, it is yet full of promise. They actually number 512, with an aggregate capital of several million francs.

Le Creusot, France's mammoth industry, offers a striking contrast to the "associations ouvrières," as it is a triumph of personal power in industry. Mining operations were started at Le Creusot as far back as 1782. Since 1836, Le Creusot has been identified with the Schneider family, whose actual representative is the

(*Continued on page* 94)

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Economy Advantages of THE EDGE MOOR BOILER



I. The Header Construction

PERHAPS the most distinctive feature of Edge Moor design is the header construction. Contrary to the usual construction, Edge Moor headers are extended, at full width, well above the tops of the drums. Thus the drums enter the header with their full area, providing a much larger throat for the liberation of steam and reducing to a minimum the frictional resistance encountered by the steam in its course to the drum.

For connecting the front and rear plates of each header, forged steel channel troughs of U-shape are used at bottom, top and sides. As shown in the above illustration, the flanges of these troughs are riveted to the inside of the plates, providing an exceptionally strong built-up construction.

The side channel troughs are forged with a slight bend at the point opposite the top of the handhole plate. This is done to secure the proper inclination of the tubes and to maintain an even water level in the drums—a method that has proved superior to the more usual custom of building straight headers and then setting the entire boiler at an angle for tube inclination.

Since not only the capacity and efficiency of a boiler, but maintenance costs as well, are largely influenced by the area provided for free circulation of water and steam, the importance of this construction will be appreciated.

Complete details of Edge Moor design and construction, in addition to much general information of value to operating men, are given in Catalog No. 63. We shall be glad to send a copy at your request.

EDGE MOOR IRON COMPANY

Established 1868

EDGE MOOR, DELAWARE

New York Chicago St. Paul Boston Pittsburgh Charlotte Los Angeles

EDGE MOOR BOILERS
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Mogul Reelites are regularly furnished with any desired length of two or three conductor "Super-Service" cable. One inch male-threaded hubs facilitate mounting on brackets or machine frames.

A Guardian for Your Power Cords

No longer is it necessary to drag long, tangled lengths of heavy cable around over the floor when portable power machines are moved from place to place. The Mogul Type Reelite has eliminated that.

All of the cord not needed is kept coiled in the steel container of the Reelite, protected, clean and unkinked. It is easily unreeled as the machine is moved to greater distances and automatically reeled as the machine is brought closer to the power outlet, thereby saving much time and trouble and freeing the cords from the wear to which they are usually subjected.

The Mogul Type Reelite can easily be attached to any portable machine, or, if desired, it can be mounted at the outlet for extending power to the smaller machines and hand tools.

There is a type and size of Reelite adapted to every power extension requirement. Let us tell you more about them.

APPLETON ELECTRIC COMPANY
1716 Wellington Avenue
CHICAGO

MOGUL TYPE
Reelite
REG. U.S. PAT. OFF.

(*Continued from page* 92)

very distinguished gentleman Eugene Schneider, president of the Iron and Steel Institute. The total area of the land owned by Messrs. Schneider in France is 17,000 acres, 3,000 of which are required for shops and offices. The length of railroad tracks within the grounds is 500 miles; on these tracks run 100 locomotives and 6,500 cars. The central works are divided between Le Creusot proper, The Breuil, and the Henri Paul Works, extending for a length of 9 miles and employing thousands of people. The Breuil works produce 300,000 tons of choice steel per year; there are manufactured 350 locomotives. Everything that can be made out of steel and iron is produced by Messrs. Schneider and their associated companies. Such is a part of the organization which is under the guidance of Mr. Eugene Schneider, whose industrial ideals therefore affect thousands of employees.

The social ethics of Schneider, Ltd., seem to have evolved from mere paternalism to a mixture of paternalism and personal power, coupled today with scientific management. Let us look into its special features. The Creusot baby is cared for from pre-birth to old age. Women employees bearing a child must stop work two months before normal confinement. The works have a lying-in ward with all modern conveniences, including electric incubators. Half-orphan children have a home surrounded by a twelve acre park and are brought up there until they are fifteen. At school age they are sent to school; and the glory of Le Creusot is the schools. The elementary plus the preparatory schools will fit a boy to start work as a cadet in the factory. To the more ambitious are successively open: the special group, the High School, and the College, or Arts and Trades School. Loans of honor, to be reimbursed in after years, enable the most efficient to reach the government engineering schools of Paris. All along professional training is carefully taught. Thus a selection of material furnishes the Schneider works with young men fit for each kind of position from lower to higher. For the girls special tuition is given in household economy.

Health and safety receive special care. A safety first inspector is entrusted with precautions to be taken against labor accidents and risks of fire. The rules include general measures applicable to all departments, and chapters of special rules for each class of machines. Foremen receive together with the general prescriptions the chapters applying especially to their department, which information they must periodically read aloud and comment upon before their men.

A copy of rules is given to a man upon entering the works, and he must give a receipt for it. This constitutes the contract. No time-limit being specified, the men are as free as Messrs. Schneider to sever relations when they choose. But, wages and conditions of employment being fair, there is a remarkable stability.

Workmen's delegates selected from and elected by their fellows seek both to improve their lot and to promote good will. They are used also by the management as channels of direct intercourse with the various corporations. All petitions and complaints received and forwarded by the delegates are examined with the utmost care; during the past few years two-thirds of those presented have been granted. They cover the system of work, unemployment, working hours, discipline, wages,

(*Continued on page* 96)

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Mack Truck Parts are Shipped in Pioneer Boxes

The International Motor Company use the same degree of thoroughness in their shipping room that they do in building Mack Trucks. Their decision to ship in PIONEER (Wirebound) Boxes was the result of careful investigation.

Read the following letter from Mr. L. J. Bennett, General Service Manager. It is worth while.

"It gives us great pleasure to state that we are more than satisfied with your PIONEER wirebound boxes, and that we do not hesitate to give them our unqualified endorsement.

"They are light in weight, which is an important item, as it saves us a considerable amount on our shipping expense.

"Since using your boxes, we have had very little breakage in transit. This has resulted, not only in a reduction in our losses in this respect, but also in our being able to give our customers quicker, better service.

"It is needless to say that in view of the fact that PIONEER boxes have been giving us entire satisfaction, we expect to continue using them."

Large and small shippers in every line of industry are giving their products better protection, increasing the efficiency of their shipping department and saving money by using PIONEER Wirebound Boxes and Crates.

It will cost you nothing to find out how they are doing it—and how you can do it. A short letter to us is all that is necessary.

Write for "General Box Service"—a booklet of information on better boxing and crating methods.

ENERAL BOX COMPANY

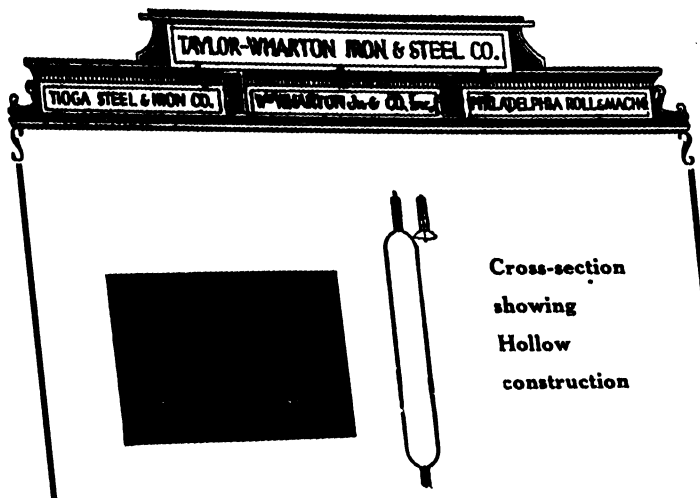
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SEVENTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

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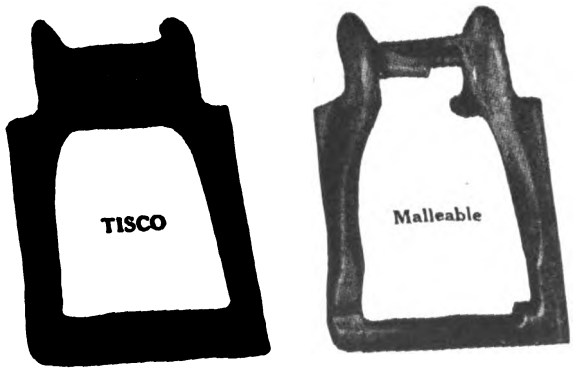
Cross-section showing Hollow construction

SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Made in one piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained where strain is most severe. Yet, because they are hollow, they are light in weight—saving in freight—easy to handle—power cost reduced. Built on order to meet requirements.

Wm. Wharton, Jr. & Co., Inc.
Easton, Pa.

Cylinders for high pressure gases, Seamless steel tubing, special trackwork for Steam and Electric Railroads.



TISCO MANGANESE STEEL CHAIN

Compare the condition of these two links placed in the same line of chain at the same time—one of Tisco Manganese Steel No. 103 Chain and the other of malleable chain. Manganese Chains usually last from five to fifteen times as long as malleable chains. Wherever equipment is subjected to hard wear or handles gritty materials, Tisco Manganese Steel will give greatest service.

Taylor-Wharton Iron & Steel Co.,
30 Church St., New York City

Chain and sprockets — Dipper teeth — Liners for ball mills — Mantles and concaves for crushers—Jaws for jaw crushers

Bulletins covering the products of the several companies will be sent on request.

(*Continued from page* 94)

machinery and equipment; and herein comes the spirit of association.

Monsieur Schneider is a firm believer in helping the individual to a useful specialization, although he does not believe in submerging in over-specialization his scientists and top men of broad view. He is taking the American point of view that in most cases "humanized industries" are a natural sequence of organized business, and social welfare a part of the whole plan. He says: "Most of our industrial problems take us back to the securing of a good organization, before anything else, even before purely scientific pursuits. We must first put our house in order, that everything being in its place the chiefs and scientists may have their full liberty of mind devoted to their investigations." As a proof of the value of organization Monsieur Schneider shows that in a particular case when the work to be accomplished was let in the workrooms under the old routine and also under scientific management, the times of manufacturing were respectively 43 days and 11 days.

Midway between Guise and Le Creusot we may note the thoughts of a representative selection of French manufacturers on actual industrial ethics.

Mr. Hanra, Eastern Mines Director: "The main need of the working class is education. But the employer must go carefully in that direction; he must know thoroughly the state of mind of everyone, lend only a hand, encourage personal initiative and coöperation for the raising up of the whole community.

"I am sure that the employer must evermore concern himself with the welfare of the worker, and not only by interest but by fellow feeling. . . . Find the way to his heart and then the great problem of capital and labor will be adjusted. Life during the Great War, when we were all mixed in ranks and files, taught us to have a better knowledge of ourselves, to love better one another. Let us now call our industrial troops to order and find the true chiefs."

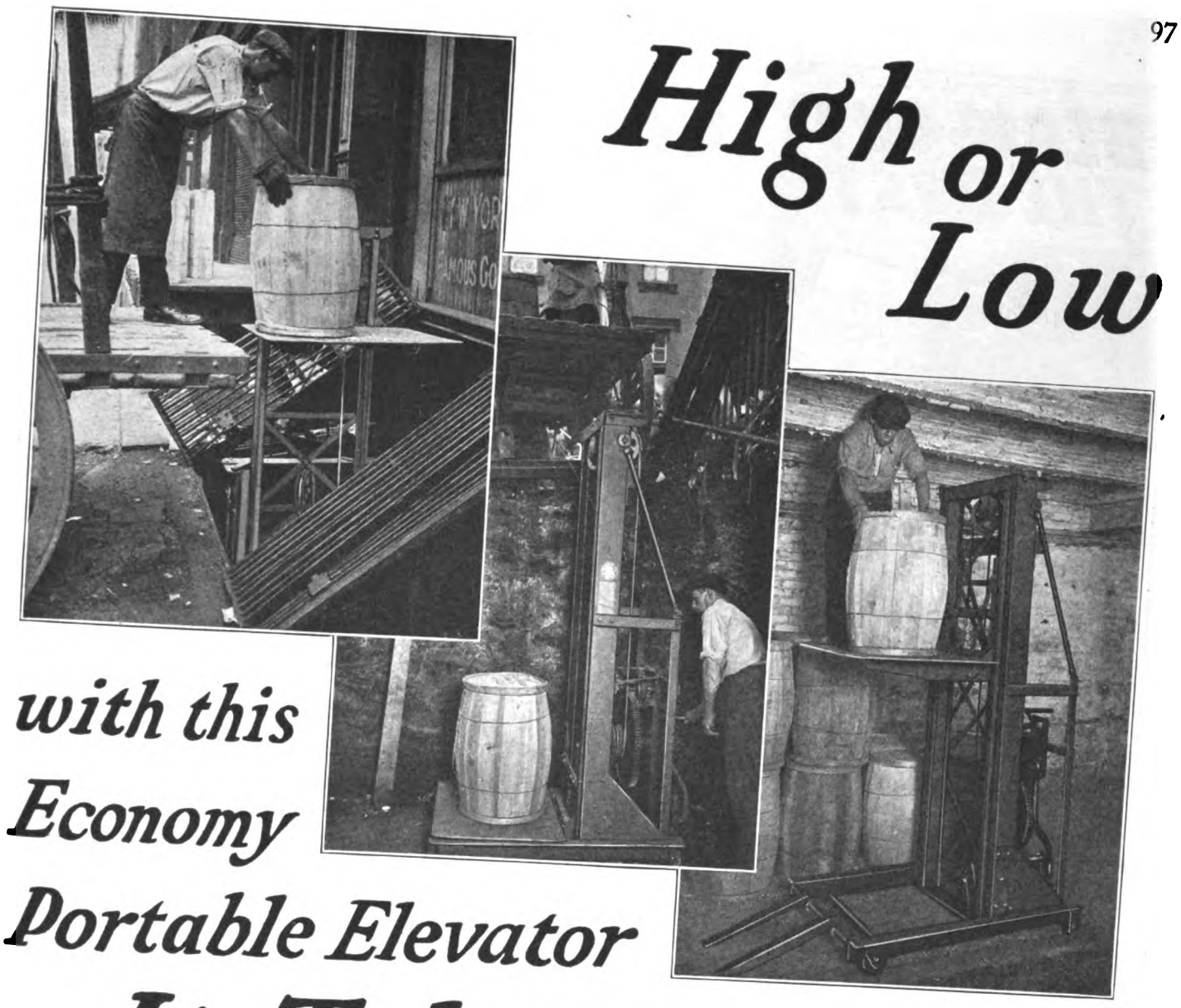
Messrs. Valon Argod Mossand, Southern Hat Manufacturers: "We believe that human capital, living asset to production, is much more valuable than the materialistic or dollar capital. According to our experience a well paid, healthy, agreeable work brings peace to the minds, strength to the bodies, security to the lives of the workers, stability to their employment. Moreover, the manufacturer is morally and materially the gainer."

Les Etablissement Réunis, Middle France Cloth Manufacturers: "Every job is to a certain extent a social function and every trade a social ministry. Then, every lack in the professional ethics is detrimental to the commonwealth. The employer who only sees in his business a money-making machinery, and the employee who looks upon his daily task as a bread-getting drudgery, are both to be pitied. Let us put conscience and good will in our work. Life will then be brighter to us; we will efficaciously coöperate to social peace, first step towards the peace between nations."

Messrs. Fraenkel and Herzog, Western Cloth Manufacturers, president of the Chamber of Commerce of Elbeuf: "Our working people are our best friends. We want to deal honestly with them." They have a model nursery for the use of the mother-employees, and have erected a garden village for their workers, in memory of their two sons killed in the war.

(*Continued on page* 98)

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High or Low

with this Economy Portable Elevator

It Telescopes

HIGH or low—up through the trap door to the wagon level or down under the low brick arches in the basement, the Economy Telescoping Machine adjusts itself automatically and does its work at either height.

Think what this means to you. It is now possible to get a portable elevator that will work in the odd places around the plant, places where steam or sprinkler pipes interfere, where overhead beams or trusses cut down the headroom or where ceiling heights vary considerably.

If you have such places where you wish to use a piler, this new Economy Telescoping Portable Elevator will do the work as no fixed height machine can. Write for working model showing how it is done.

Economy Engineering Company

2663 West Van Buren Street, Chicago, Ill.

We have a representative near you.

New York Office: 342 Madison Ave.

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-With a CADILLAC Portable Electric BLOWER

Equipped with Norma Ball Bearings
Requires No Oiling!

Your moving machinery is full of abrasive dust and grinding grit which is causing unnecessary friction, untimely deterioration, loss of power and heavy fire risks. There are countless particles of carbon in your motors, constantly threatening you with costly "short-circuits" and "burn outs." You can positively keep these destructive agents out of your machinery with a CADILLAC Portable Blower. *Its dry air cannot injure windings or insulation.*

Has hundreds of uses. Weighs 6 lbs.—attaches to any light socket. Thousands in use in practically every line of industry.

Write for descriptive folder giving prices, etc.

CLEMENTS MFG. CO.

Manufacturers of the Cadillac Electric Vacuum Cleaner

612 Fulton Street **Chicago**

Canadian Factory: 74 Duchess St., Toronto
Export Department: 149 Broadway, New York City



For the buying facts regarding

Industrial and Power Plant Materials and Equipment

See Sweet's Engineering Catalogue

(*Continued from page 96*)

The Orleans Railroad Co., Paris, have just started a school on wheels on the American plan, for their employees along all their lines, and have introduced scientific management into their shops.

American associated factories established in France, such as the General Electric (The Thomson Houston group), the Goodrich Co., etc., have introduced with them most of their social features.

The eight-hour work day introduced into France since the war was an incitement to organizing the leisure of the workingman. Workingmen's and allotment gardens are among the most notable features of such organization. The last available statistics of the French Department of Labor, released February, 1923, show that there are about 125,000 gardens of an aggregate amount of 15,000 acres, provided by French manufacturers to their employees,—four-fifths of which belong to mining companies.

The industrial societies in every region of France may be called societies of applied industrial ethics. They organize lectures, consultations, conventions on all the big problems of modern industry and of human engineering. The three most active are the Societie Industrielle de L'Est (Nancy), the Societie Industrielle de Sotteville Inferieure (Rouen), and the Societie Industrielle du Nord (Lille). Thus, east and west, north and south we see in France both a wide interest and an effective organization for better and more human industries.

To dwell on every country in Europe would be to enlarge without adding to our general synopsis.

Germany has its main industries concentrated in the Ruhr and Rhine districts. There you can find every great iron and chemical works with its "wohlfahrtseinrichbungen" (social welfare departments) under strict discipline. In the Stollwerck cocoa works, near Cologne, you will find a fine spirit, not only of discipline but of real good will.

Belgium has its old industrial ethics in such companies as the Societie de la Vielle Montagne, and new ones in such mining companies as those of the Campigny district.

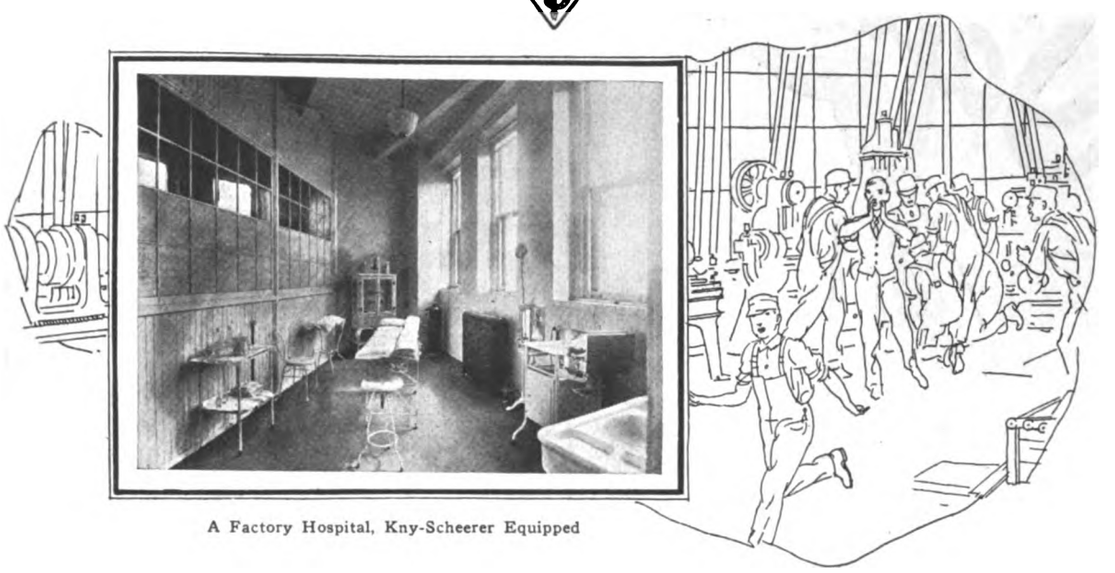
Holland's most famous works organized with extensive consideration for the workers are those of the Marken of old times, and of the Brothers Stork-Hengels, of modern interest.

Italy, lastly, around Milano, has splendid works, where industrial ethics are applied to a vast number of workers.

As far as *Scandinavian, Tchecko-Slovakian, and Balkan* states are concerned, you will find a rising spirit in the lot of the workmen, on the part of the manufacturer. The Department of Labor of the new state has a notable part in the government of the nation, crowning the whole structure is the *I. L. B.* at headed by a man radiant with optimism, full of knowledge, acquainted with philosophy,—Professor Thomas, former employer of labor in the ex- Secretary for the Department of Munitions.

At the end of this survey, many will indict having reviewed the European situation from an altitude that only the most prominent groups show, of having given an air photo. It is true much misery in old Europe's industrial con- But it is as if in a decayed ground are found up beautiful trees, strong and promising.

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A Factory Hospital, Kny-Scheerer Equipped

Provision for emergencies inspires confidence

When the Unexpected Happens---

INSURANCE, inspection and precaution have not made fire departments less valuable to the community. Quick attention is recognized as being equally important with prevention in keeping down property losses.

Well equipped plant hospitals, like fire departments, are invaluable when the unexpected happens. Safety devices, safety education, and other means of reducing accidents, are not enough protection from injuries and loss of life. Facilities for providing immediate relief when the accident occurs prevent small mishaps from becoming serious and bring the injured workman back to his bench with a minimum of time lost.

Expert assistance in planning and equipping plant hospitals is rendered by the Engineering Department of the Kny-Scheerer Corporation. Over twenty-five years' experience in the manufacture of hospital instruments and equipment is at your disposal on request.

Electro-Medical Apparatus
First Aid Equipment
Hospital Furniture
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Instrument
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Water
X-Ray Apparatus and Equipment

The KNY-SCHEERER Corp. OF AMERICA

119 Seventh Avenue —Dept. L **New York, N.Y.**

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It makes him a faster, better, safer workman—

The workman who uses a Dayton Safety Ladder does a lot to reduce your maintenance costs. Every job he does is done in less time, done more thoroughly, and done *safely*.

He has two hands free for every job, instead of having to steady himself with one hand. He *feels* safe and he *is* safe. He can devote all his attention to the doing of a *good* job,—and he can do it in less time.

Built of strongest wood, braced throughout with steel, it is the *only safe* ladder. It is made in right sizes, from 3 to 16 ft. It meets every ladder requirement.

We would like to send you the actual facts that tell how Dayton Safety Ladders have prevented accidents, reduced overhead costs, paid for themselves over and over again in hundreds of the best-managed industrial plants.

Write to us today.

THE DAYTON SAFETY LADDER CO.,
Dayton, Ohio.

DAYTON Safety Ladder

Barring the Gates

(*Continued from page* 19)

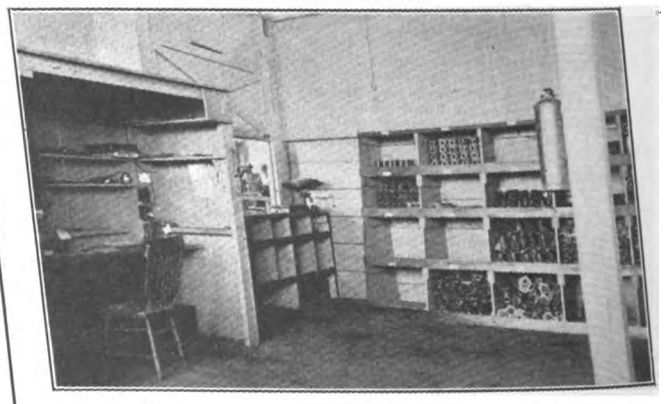
that demand is reasonably constant or, in other words, that industrial activities continue next year on the same level as last year, this means that improved machinery and improved management must together make up a labor deficit of one hundred and fifty million dollars, if management is to fulfill the obligations which this restriction in labor supply places upon it. If management does not do this, we will have wage inflation or, in other words, increases in pay without corresponding increases in production.

Assuming that the meeting of this labor deficit is divided equally between management methods and improved equipment we have seventy-five million dollars' worth of additional work to be done by new and better machinery. A machine that is capable of earning twenty-five per cent. annually upon its purchase price is looked upon as a prime investment. Here then is a demand, created by the new restriction, for three hundred million dollars' worth—per annum—of improved labor saving machinery.

So the subject of immigration restriction drives straight home to the individual American industrial executive. The National Government can pass the law putting restriction into effect—it cannot pass laws to meet and offset the result of restriction. *That* part of the task belongs to American industry and must be faced by every industrial executive—not merely as a patriotic duty but as a means of preserving his own prosperity.

THE manager of the old established factory who is having trouble with his production may find the root of the whole difficulty in his store room.

The store keeper who is given a sufficiently large and well arranged room will, if he is at all competent for such a position, keep his stock in an orderly manner and will thereby contribute greatly to the total of plant efficiency. Each bin may be marked with part numbers and names so as to facilitate location by inexperienced clerks. Maximum and minimum quantities may also be recorded and in the absence of a complete dispatching system the store keeper, by watching the low bins as orders are filled, can keep the manager advised as to parts orders which should be started through the shop or purchase orders which should be issued.



Is your storeroom functioning efficiently?

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Don't do without a standard crane for low headroom.



A recent issue of Industry Illustrated says—

"Many old foundries and other shops are doing without the services of overhead cranes because they feel that the cranes require too much headroom to fit into their buildings. This is often true of standard cranes, but in such cases special low cranes can be designed and installed."

But why install a special crane, when the NORTHERN TYPE LE, an entirely standard crane, is designed especially for and meets every condition of low headroom and high hook lift?

Standard NORTHERN TYPE LE cranes in capacities from 1 to 10 tons capacity are being used in many plants where it was thought impossible to install an overhead crane and are giving excellent results.

Our LE Division will be glad to show you how a standard crane can be used where headroom is limited. Tell us about your conditions and let us send complete information.

NEW YORK
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PITTSBURG

NORTHERN ENGINEERING WORKS,
2611 Atwater St., Detroit, Mich.
Canadian Plant: Northern Crane Works, Ltd., Walkerville, Ont.

ST. LOUIS
LOS ANGELES
NEW ORLEANS
TORONTO

NORTHERN CRANES

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A True Steam Trap—Not a Hot Water Collector

The object of a steam trap is to save steam.

Steam traps of the "bucket" or "float" type are simply receptacles for water that has dropped below the steam point and they waste instead of conserve steam.

Steam Trap Sarco *saves* heat by passing the condensate on to the hot well as *rapidly as it collects.*

There is no chance for the condensate to collect and cool. The automatic operation of a sensitive expansion element opens and closes a valve, releasing the hot condensate the minute it collects.

The Sarco can be installed quickly on any steam line without resorting to expensive construction work. And it costs only one-third as much as a "bucket" type trap.

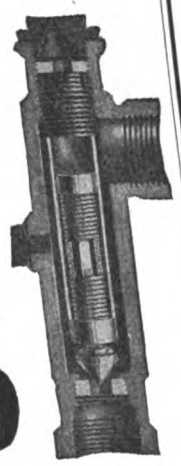
Our 30-day free trial offer gives you the option of putting the Sarco to a test at our expense.

Write today for Booklet R-8

SARCO CO., Inc.

236 Broadway **New York**

Boston Chicago Detroit
Buffalo Cleveland Philadelphia
Peacock Bros. Limited, Montreal



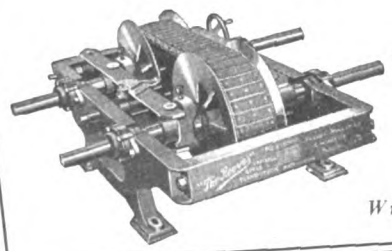
STEAM TRAP SARCO

There's Only One *Accurate* Method of Speed Control!

NO longer are progressive manufacturers content with "makeshift" variable speed control devices. Modern production methods demand *unfailing* accuracy in variable speed control.

There is only one truly accurate method—"The Reeves" Variable Speed Transmission. It is daily demonstrating its accuracy and dependability in industrial plants throughout the world. Write for full information.

REEVES PULLEY CO.
Established 1887
COLUMBUS, INDIANA



"The Reeves"
VARIABLE SPEED TRANSMISSION

Write for Catalog T-44

Do You Get Maximum Service from Your Telephone?

By Dwight G. Baird

THE telephone has appropriately been called "The Voice of The Business." Its importance in the modern factory and office cannot be overestimated. It hardly needs emphasis, however, as every plant is now equipped with at least a single station, while the larger ones have private exchanges of considerable proportions.

At the same time, expert investigation often reveals that even the most modernly-equipped and efficiently-operated plants do not get the maximum of service from their telephone system. Telephone companies in many cities have therefore recently inaugurated special service departments for the express purpose of coöperating with



This is how the telephone company operators do it. Demonstrating the proper method of "plugging in."

such subscribers to the end that they may enjoy the best service possible to be had. The service department, at the invitation of the subscriber, makes a survey of the private exchange and all its connections, installs new equipment where needed, and offers suggestions for removing causes that have been interfering with the service, for making additions or changes, and for training employees in the proper use of the telephone. The service is of course free, the surveys and recommendations being made for the sole purpose of coöperating with the subscriber in bettering the telephone service.

An account of conditions found to obtain in a number of plants may prove suggestive to others.

The heart of the telephone system in a large plant is

(*Continued on page* 105)

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Meeting the Needs for Suitable Equipment for Power Plants

WEBSTER equipment fulfills the requirements of every power plant operator and owner who appreciates the best methods as expressed in coal and ashes handling machinery. The big reason for the 100% service which it gives is because each installation is exactly fitted to the work required.

Webster equipment for large or small power plants is the culmination of years of experience in building and designing machinery for this work. During this time Webster engineers have thoroughly studied the correct handling of coal and ashes in power plants, and can ably assist in specifying suitable equipment to meet all needs. Check up on your coal and ashes handling equipment with a Webster engineer!

THE WEBSTER MFG. COMPANY

4500-4560 Cortland Street, CHICAGO

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BUFFALO.....902 Ellicott Square
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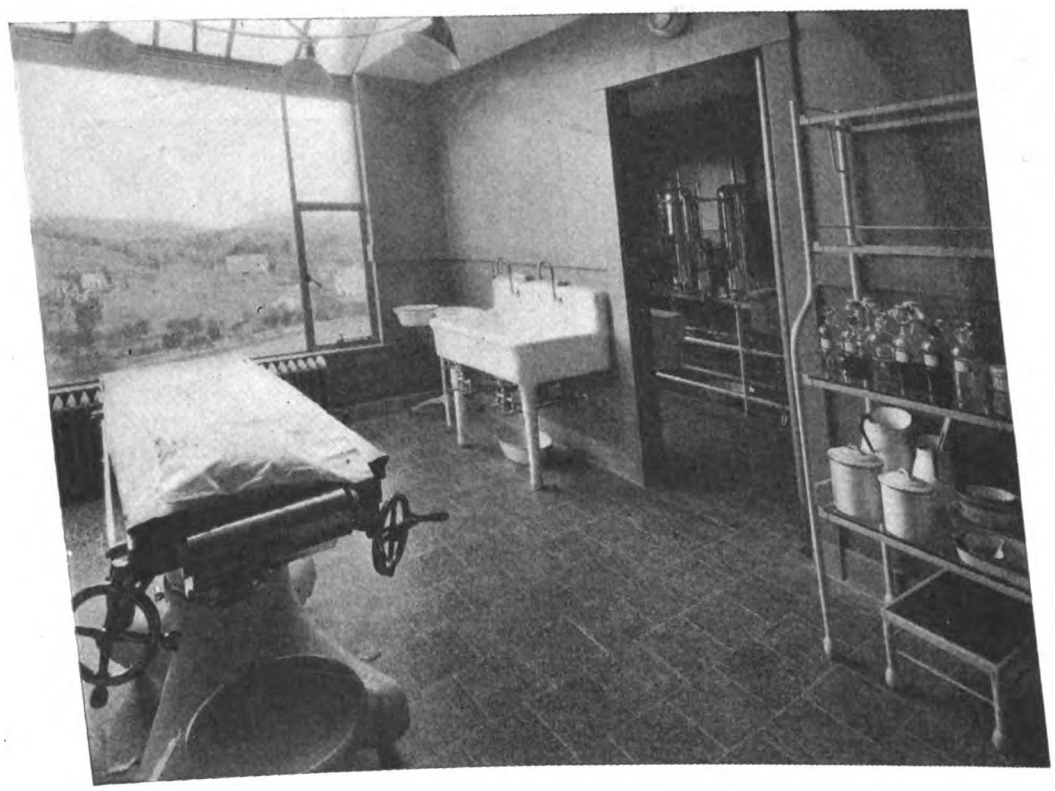
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Denver, Colo.....C. L. Dean, 1718 California Ave.
Detroit, Mich., Palmer-Bee Co., 2778-2794 E. Grand Blvd
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Louisville, Ky...E. D. Morton & Co., 516 W. Main St.
Memphis, Tenn..E. C. Atkins & Co., Maine & Butler Sts.
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Salt Lake City, Utah, L. W. Mendenhall, 517 McIntyre Building.
Salt Lake City, Utah.....Galigher Machinery Co.
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Vancouver, B. C...B. C. Equipment Company, Ltd., 613 Bank of Nova Scotia Bldg.

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NORTON FLOORS



A Floor That Is
Safe—Durable—Quiet

The floor of the hospital operating room offers an opportunity for a real test of service. Here as in many other places Alundum Tile is satisfactorily solving the problem of safety with its non-slip surface, durability, quietness, easy cleaning, and appropriate color harmony.

Safety and durability are paramount features.

There are Alundum Tiles and Treads for all places where a non-slip floor is desirable and where economy depends on wear-resisting qualities.

These Norton floor materials are made in forms suitable for all types of buildings—school, hospital, hotel, municipal, office and industrial.

NORTON COMPANY

WORCESTER, MASS.

New York **Chicago** **Detroit** **Philadelphia**
Hamilton, Ontario

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(*Continued from page* 102)

the private exchange switchboard and it is here that the surveyor begins his investigations. Is the board large enough to handle the volume of calls? Does it have a sufficient number of trunk lines? Is the operator properly trained and does she discharge her duties in a proper manner? Does she have a rest period in the morning and another in the afternoon? Is her position properly lighted and ventilated?

In many cases it has been found that the subscriber should have a larger switchboard. An 80-line, one-position board perhaps should be enlarged and made a two-position board, so that another operator can be added. One operator may not be able to handle the volume of calls expeditiously. She is overworked, with the result that she becomes tardy in answering calls, users become impatient and begin to scold, and she, in turn, "sasses back."

In more than one plant it has been found that the operator's burden is increased by the lack of coöperation on the part of executives and others. Executives are, in fact, usually the worst offenders in this respect. They leave their offices without letting any one know where they are going and as they pass from one department to another, the operator is constantly trying to locate them, perhaps, when she should be giving her undivided attention to her board. Others take the attitude that the operator is but an employee whose time is worthy of little consideration as compared with their own, forgetting that when they put the operator to needless trouble, they are slowing up their whole telephone system. Unless an autocall is provided for locating executives when out in the plant, they should notify the operator where they will be at different intervals or else they should call her from time to time and ask whether any one has inquired for them.

Allowing other employees to gossip with operators, either at the board or over the telephone, is also often found to be an important contributing factor that results in poor service.

The practice of asking the operator to get the desired connection, then call the speaker is permissible, provided the operator has plenty of time, but it may interfere with her other work to such an extent as to interfere with the entire system, resulting in poor service for everyone.

On the other hand, it is often discovered that delays are caused by not having a sufficient number of stations, by the stations not being properly distributed, or by extension lines that might as well as not be direct lines.

In one automobile factory, for example, a number of minor executives had no instruments on their desks, but had to get up and go to a station every time they had cause to use the 'phone, while several instruments scattered throughout the offices were used very little and might very well be removed. On the one hand, this manufacturer was allowing employees to waste considerable time in strolling back and forth between their desks and the telephone stations when it would have cost only three or four cents a day to place instruments within their reach, and on the other, he was paying for a number of stations that were used very little. They had been used at one time, of course, but a rearrangement had left them idle. A little readjustment here improved the service, saved considerable time, and cost nothing.

In the same plant were a number of extension lines that were kept very busy. For some reason, the manage-



Clipping The Hair Of A Nation!

TODAY, in thousands of busy barber shops, men ease themselves into friendly chairs and have their hair cropped in a better, quicker way by an electric clipper. Thanks to the fractional horsepower motor—which made this ingenious device possible—another visionary possibility has become a practical reality. Thanks to Dumore fractional horsepower motors and to Dumore advisory engineers, the Moore Electric Hair Clipper—pioneer of them all—has won and retained the leadership of its field.

Perhaps our Engineering Department can do for you as they did for Moore. The personnel of this department have for years been accustomed to adapting fractional horsepower motors to new applications. If you are developing a motor driven device, tool or appliance and find a perplexing power problem retarding its success—or if you are a manufacturer planning to change the power unit you are now using, you will find the advice of these experts to be extremely useful. Write them any time—they welcome problems that aren't easy.

WISCONSIN ELECTRIC COMPANY
7000 Sixteenth St. Racine, Wis.



Type-SAX
1/8 h.p. motor with special base. Operates on A. C. or D. C.



Type-A—Stripped
1/3 h.p. Cast iron frame, enamel finish, Babbitt bearings, wick oil feed. Operates on A. C. or D. C.



Type-D
1/4 h. p. Cast iron frame. Enamel finish. Plain bearings. Grease cups. Operates on A.C. or D.C.

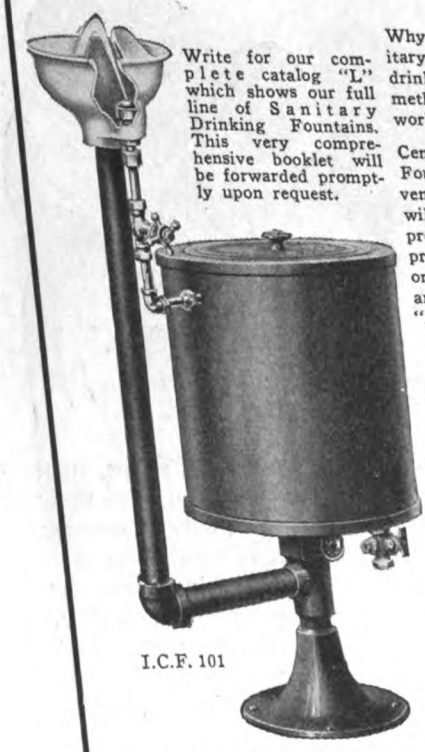


No. 3GM—Stripped
1/4 h. p. Aluminum frame. Enamel finish. Norma Bearings. Ventilated. Operates on A. C. or D. C.

Dumore
Fractional H.P. Motors

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Save their Steps and Protect their Health



Write for our complete catalog "L" which shows our full line of Sanitary Drinking Fountains. This very comprehensive booklet will be forwarded promptly upon request.

Why tolerate any unsanitary buckets, common drinking cups or other methods injurious to the workers' health?

Century Sanitary Bubbling Fountains, placed at convenient places in your plant, will save many steps and prove an aid to increased production. They are economical in the use of ice and the water is always *"ice cooled"* — not *iced.*

CENTURY
Sanitary Ice-Cooled
Bubbling Fountains

can be supplied in a size to suit your needs. They are heavy built, dependable and durable. Coils are of tinned copper which will not rust or corrode. Equipped with porcelain enameled bowl and nickeled trimmings.

I.C.F. 101

It will pay you to get all the information now and be prepared for the hot summer days.

CENTURY BRASS WORKS, INC.
Belleville, Ill.

Materials Handling Engineering Service

My experience of many years in the field of materials handling equipment is available to plant managers in helping them towards a more practical and economical selection of the proper and most applicable equipment exactly suited to every individual industrial requirement.

This service fills a long felt want and I shall be glad to send information to any industrial executive whose problem is the installation of cost cutting, economical materials handling equipment.

J. GRANT CLINE
Materials Handling Engineer
Engineering Bldg. New York City.

ment had wanted to have more than one instrument on each of several lines and the result was that when one of the parties on the line had cause to use the 'phone, he almost invariably found the other party already using it. This of course caused much annoyance and delay and saved nothing, as direct-line stations cost no more than those on extension lines.

In another plant no effort had ever been made to curtail the use of the telephones by office employees, with the result that they spent a great deal of time "chinning with their sweeties" and running up the telephone bill for the company when they should have been attending to other duties. Stations were installed in the rest room and recreation room for their convenience when off duty and orders were issued that employees should not use the telephone for private conversation at any other time.

Telephone equipment, like any other material, is subject to depreciation and it is surprising how many bell boxes one may find torn from the wall, how many transmitters broken or missing, how many cords are frayed, how many felt bases of instruments are worn away, and how much other dilapidation becomes evident when once a survey is undertaken. It costs no more to have all equipment kept in first class condition.

In one plant, executives were mystified by the fact that the whole telephone system was deranged regularly the first of every week. When the service department of the telephone company finally was asked to find and remove the trouble, it was discovered that the wires in the floor had been run in moulding instead of in the conduits provided for the purpose. As a result, when the janitors mopped or scrubbed the floor each week-end, water seeped down into the moulding, dampening the telephone wires and putting the system out of order. The conduits had been improperly installed and could not be used. In this case it became necessary to rewire the entire building, running the wires on the ceiling of the floor below and bringing them up through a concrete floor. This was done without cost to the company.

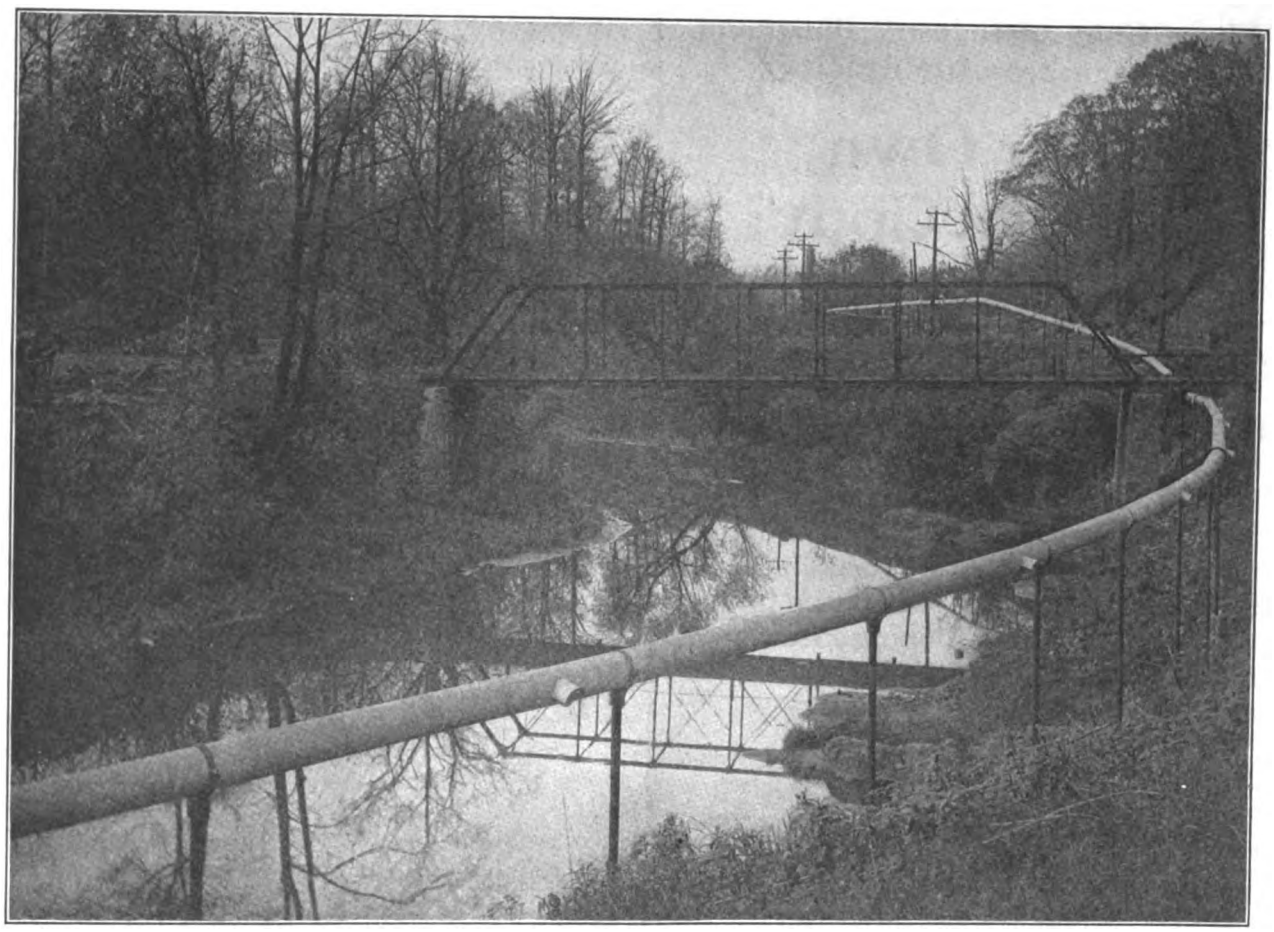
One large company that has several different plants in the same city learned, as a result of such a survey, that its operators in the different plants had developed considerable ill feeling among themselves, due to their being overworked and trying to "pass the buck" one to another. Additional tie lines (inter-plant lines that do not connect with "central") were needed, as were two or three more operators. When these were installed, the enmity ceased and the service became satisfactory.

In numerous cases it has been found that the operator's position is not properly lighted and ventilated, resulting in lowered vitality and efficiency on her part. Incidentally, there is more often than not too much heat rather than too little. The work of the telephone operator is extremely trying and the conditions should by all means be made as nearly ideal as possible. Furthermore, she should be given a rest period in the morning and another in the afternoon, if for no more than ten minutes each.

It is recommended that in plants where there are many stations, the stations be numbered and a private directory be provided. This directory may be no more than a typewritten list of names and numbers, but it will relieve the operator of a great deal of annoyance and delay in getting the right parties. This is particularly true in

(*Continued on page* 108)

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THIS PNEUMATIC CONVEYING SYSTEM SAVES $7,841.60 EVERY YEAR

Four years ago the Mt. Vernon-Woodberry Mills, Inc., of Baltimore, installed Sturtevant pneumatic conveyors.

These systems carry cotton at a total cost of only $.325 per bale, compared with $.644 when teams were used.

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(*Continued from page* 106)

the case of a new operator who does not know every one in the plant by name. The larger the plant, the greater the need for using the number system.

Many subscribers call the same parties by long distance telephone every few days, or even daily, and go through the formality of giving all the details with each call. The telephone companies now recommend that such subscribers code their long distance calls and file a copy of the code with their long distance operator, for the purpose of saving the time of everyone concerned, as well as of preventing error.

The subscriber simply makes out a list of those whom he calls regularly or frequently over long distance, assigning a number to each call. Thus, number one is Blank and Company, 6618 Northwest street, Chicago, Illinois, and Mr. Jackson, general manager, is the party to be reached there. Similar details are given for each call. When, therefore, the subscriber wishes to call one or more of these long distance numbers, he merely asks the long distance operator to get code numbers so and so and hangs up. If a number of calls are to be made in succession, the long distance operator will watch to see when the subscriber is ready for the second, and so on, and will call him as fast as she makes the connections.

Thus the private exchange operator calls long distance and says: "This is So-and-so Company. This morning we wish to call code numbers four, seven, sixteen, and twenty-one." The long distance operator takes down the So-and-so Company's code as previously filed with her and there she has all the details of the several calls already written out.

At the request of subscribers, the telephone companies usually are prepared to give demonstration of how the telephone system operates and to offer suggestions to employees as to the proper way to use the 'phone. It is sometimes suggested to an executive that he go out, disguise his voice, and call up his plant, and he frequently gets an unpleasant surprise by doing so. Courtesy, a pleasant tone, lips the proper distance from the transmitter, saying who is speaking or giving the telephone number instead of merely yelling "Hello!" and similar details are little things that count for much in the proper conduct of the telephone business of the subscriber.

Finally it might be suggested that the telephone companies usually are prepared to furnish trained operators for private exchanges and it is therefore unnecessary for the subscriber to advertise for an operator unless he prefers to do so. The telephone company will send him a trained operator and if she does not prove satisfactory, it will send him others till he finds one that does suit him.

More than 200 of the leading mechanical, electrical, civil, and marine engineers of the United States are sailing on June 19th on the S. S. Scythia to attend the World Power Conference to be held in London, June 30th to July 12th, in connection with the British Empire Exhibition.

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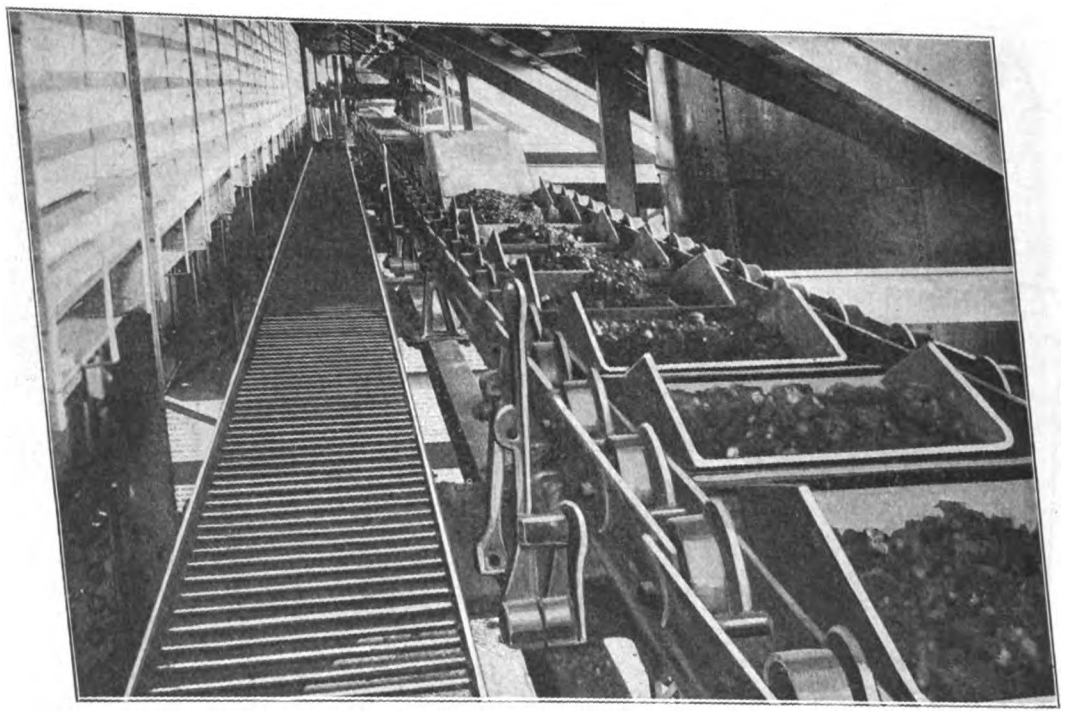
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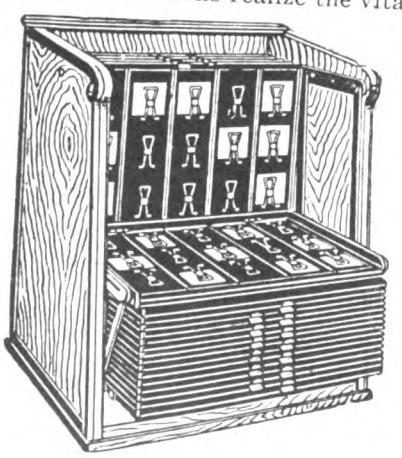
A McCASKEY helps get orders out on time—*no matter how complicated your production.*

Whether your product involves one or many processes, you know the difficulty of keeping the jams out of production—of coordinating the different steps in manufacturing. The McCaskey System in the Rochester Button Company, where they have 50,000 processes, is a striking example of how a McCaskey can help you control production and bring you many savings.

Production Control—with a McCaskey

Mr. Nelson Sage, their president, says:

"Few concerns realize the vital importance of controlling all of the elements that enter into the manufacturing of buttons from the vegetable ivory. It was to give us this control that we instituted the system we now use.



"Four years ago we established a central control production and planning department in which we installed 80 McCaskey Production Control Boards. These boards take care of approximately 5000 jobs, each of which averages 10 major operations. We also installed a number of McCaskey Department Boards and adopted the McCaskey Surety (Carbon back) Forms designed to cover each particular operation. This made it possible to tie up, with one writing, production, cost and payroll.

"In this way we get positive control of all lots of buttons in our factory which makes it possible to plan our work and move it through our plant in order and on time. Previous to the installation of the McCaskey System this was not possible.

Saves Unnecessary Labor

"The System also does away with a lot of unnecessary clerical help in our factory and gives the foremen more time for inspection. It cuts to a minimum the time required to change over machines as the foremen know definitely what job to put into operation next. The McCaskey Production Control has enabled us to get the best possible results from our factory and give service to our customers."

You may not make buttons, your production may not involve 50,000 operations, but there are great diversities of uses for McCaskey Systems. They are making savings in such work as keeping a perpetual inventory, checking tool losses, costs, and in countless other ways. You will do well to investigate a McCaskey System for your plant. We will be glad to give you more information. Write us.

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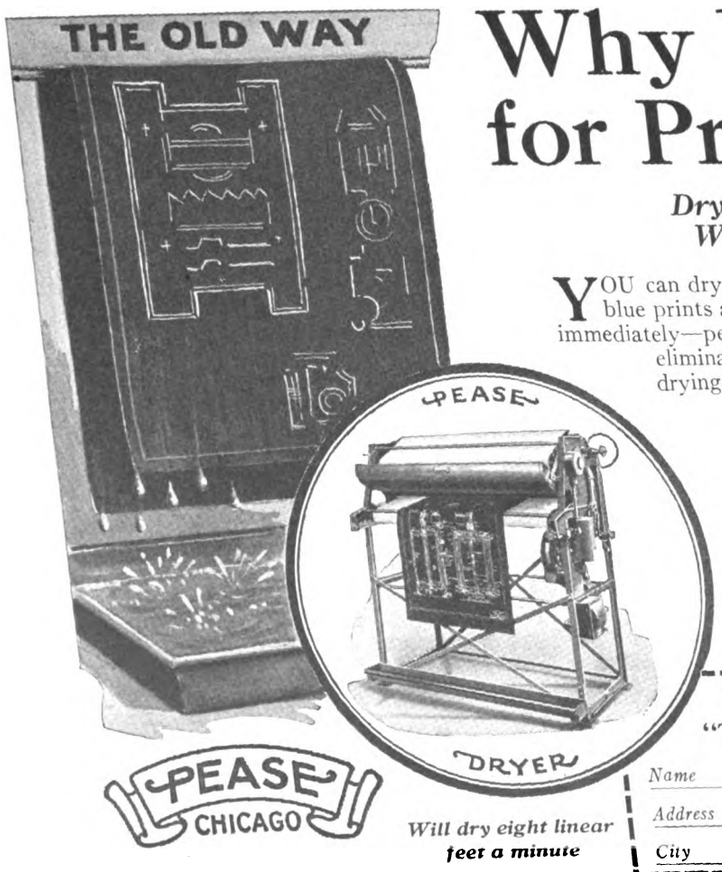
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SNAPSHOTS *of Sensible* SAVINGS

Six practical methods of cutting costs are here illustrated.

Those who are not familiar with the economies that result from the use of this equipment may find it difficult to believe that $2500 a year may be said to be a minimum for only *one* machine to save.

These illustrations are reproduced from a booklet recently issued by The Lakewood Engineering Co., a copy of which will be interesting to every reader of Industry Illustrated. Write to The Lakewood Engineering Co., Cleveland, and ask for a copy of "Snap Shots of Sensible Savings."



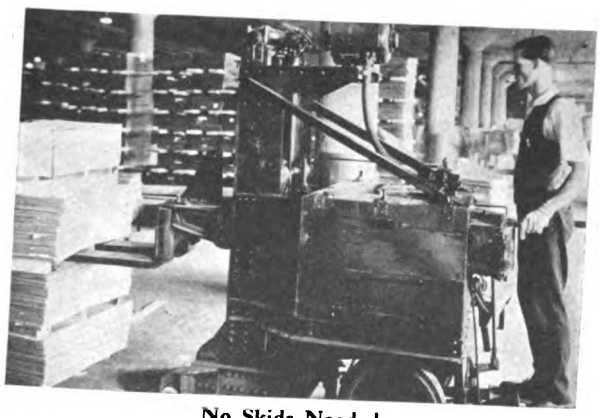
Truck Loading Simplified

The high cost of lifting and loading gets an awful wallop when the Lakewood Tier-Lift is put on the job. This Tier-Lift cuts the labor cost of shipping 30 to 50 per cent.



Production Is Continuous

The production value of costly machines is too great to allow them to be idle for even a few minutes. Bringing work to the producer on trailers and having the tractor do the hauling at regular intervals may increase capacity 10 per cent with no additional men.



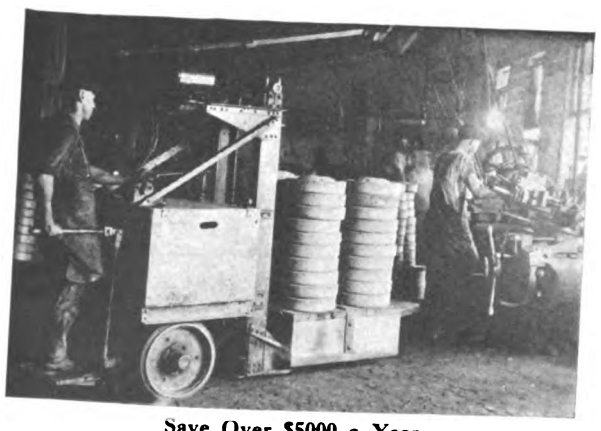
No Skids Needed

The fork attachment makes it possible to handle sheets, boxes, bales, etc., without using skids. This Tier-Lift is handling 2000 lbs. loads of sheet metal. Each load is laid on two-by-fours, providing plenty of room for the steel fork to pick up the load.



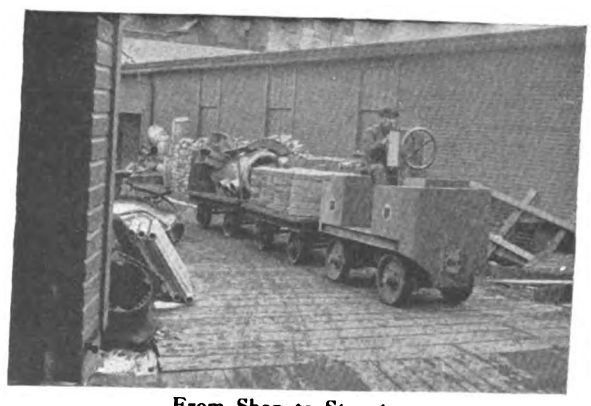
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The Lakewood Tractor and "V" dump trailer handle all sand, coke, castings and slag. They work the tractor nearly 24 hours a day. It is invaluable in clearing the floor of waste, carrying the castings to the cleaning department, and from there to storage or freight cars.



Save Over $5000 a Year

With the Tier-Lift forty fly wheels are carried on each skid. The aisles are clear and the men know that a skid load completed is 40 pieces. Increased production resulted from men not having to leave a producing unit to go get work. The resultant savings are over $5000 a year.

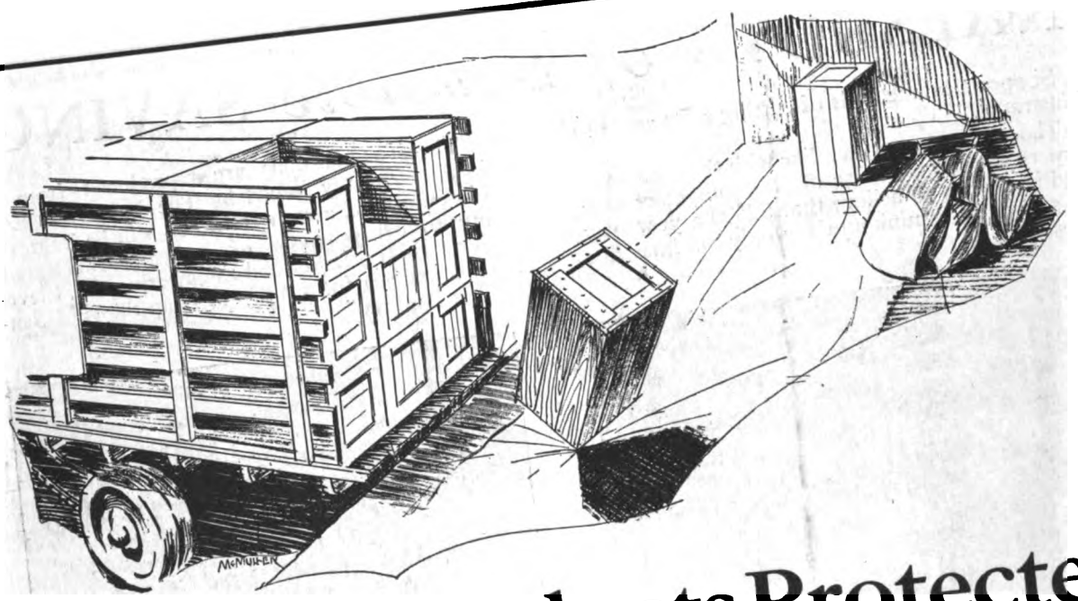


From Shop to Storage

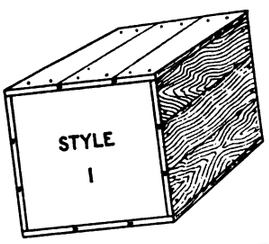
This plant works continually but stores its product to be able to take care of seasonal demand. The Lakewood Tractor-Trailer Trains reduce the cost of hauling to the warehouse. When business is brisk the product is quickly loaded.

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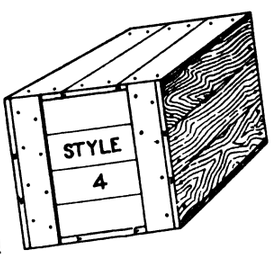
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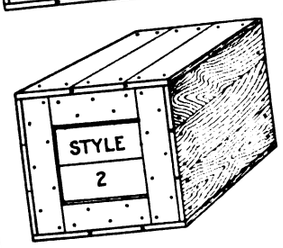


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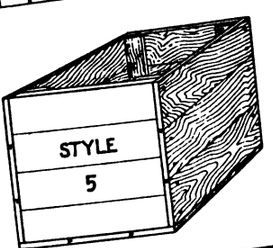


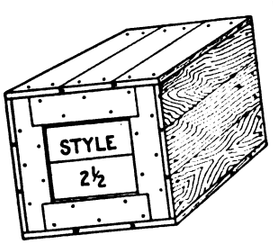
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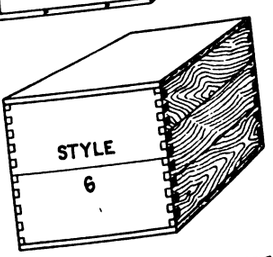




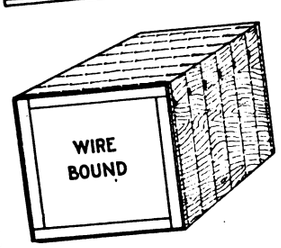
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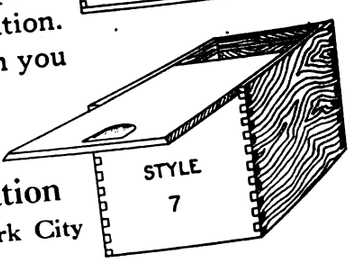






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Real Silk Hosiery Mills, Inc., Indianapolis, Ind., showing section of Order Filling Table

Conveyor Packing Table speeds boxing and cuts unit packing cost

LOW unit cost of packing, greater speed in filling orders, and smaller space requirements are some of the outstanding savings made by the novel use of conveyors as shown in the above picture.

The entire output of the great Real Silk Hosiery Mills, Indianapolis, is packed in boxes of a few pairs each for mail shipments, at this table.

Conveyors keep workers supplied with boxes

Empty boxes of the wanted sizes are stored in front of the packers, on four moving conveyor belts, running the length of the table. A stop at the end of each belt holds the boxes stationary. As an operator removes a box, the boxes behind are moved up by the belt to fill the gap, keeping a steady supply at each packer's position.

The top belt, carries the full boxes to the shipping table, and prevents the product from stacking up in front of the workers, and interfering with their output. With this conveyor system, fewer girls can pack more boxes per day. Less space is required. The cost of packing is greatly reduced.

We help you plan your conveying system

This is only one of the many ways that conveyors save money for industrial plants. The important thing in every installation is the skill with which they are applied to the task. The plan behind the conveyor is what makes for economy and service.

Lamson engineers will help you plan your conveyors, just as they have helped Real Silk Hosiery, and hundreds of others. An interview with a Lamson man will not obligate you in the least, and may lead to remarkable and unlooked for economies.

May we help you apply mechanical handling to your production problems?

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SYRACUSE, NEW YORK
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Successor to a myriad wasteful lifting methods

THE SHEPARD ELECTRIC LIFT ABOUT

In succeeding the wasteful methods sketched here, and hundreds more in practically every kind of business, the LiftAbout has put load-lifting and moving on a paying basis—by that we mean this hoist has quickly paid its cost, and continues to pay the user by lowering the price he has to pay for moving materials.

Practically unlimited in application, a LiftAbout lifts and carries as widely varied loads as ice and molten metal, sausage and steel, leather and lumber, paper and pipe, ashes and automobiles, sand and soap, barrels and bed linen—truly, it is "an electric hoist for everybody".

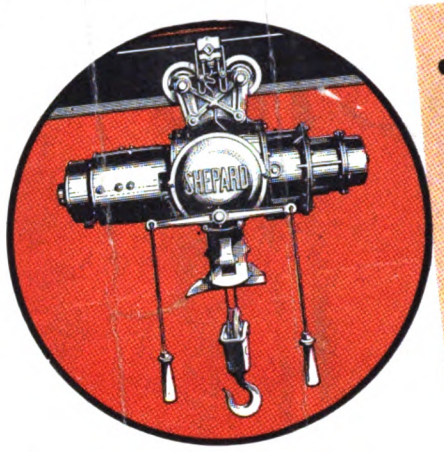
Operating on overhead track it takes up no valuable floor space, but is always instantly available for use.

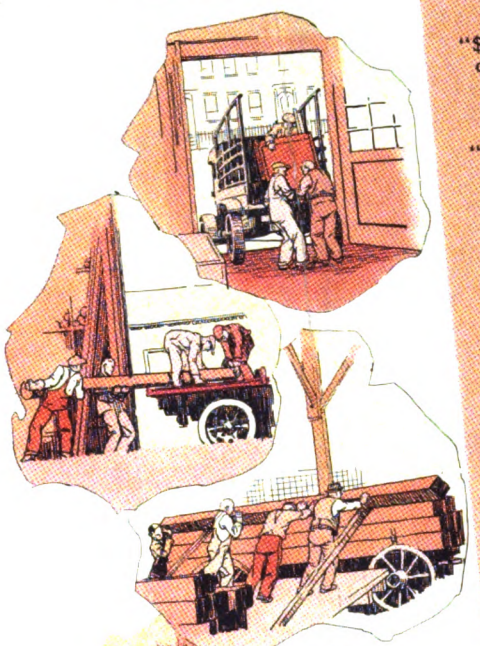
Thousands of business executives have stopped the waste of time and money that go with manual load handling. They have substituted this sturdy and economical ½ and 1 ton electric hoist for improvised methods that for years had been "eating" into profit.

Due to quantity production and standardized manufacture, you'll find a LiftAbout exceptionally low in price—it is the product of America's largest electric hoist manufacturer.

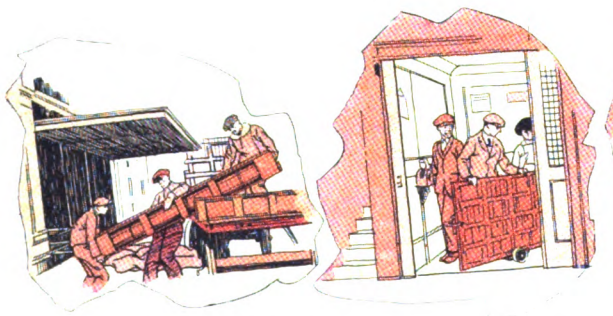
If your business requires the movement and lifting of loads—write us.

SHEPARD ELECTRIC CRANE & HOIST CO.
420 Schuyler Ave., Montour Falls, N. Y.
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An Electric Hoist for Everybody

Economies like these for your business

"$7200 yearly payroll saving with LiftAbout"
—for Biersach & Niedermeyer Co., Milwaukee.

"$6,000 cut in handling costs, output increased 25%"
—for Crese Patent Column Co., Chicago.

"3 men, sometimes 8 men released for other work—$4,400 saving"
—for Edward Hines Lumber Co., Chicago.

"Small warehouse meets labor problem, doubles capacity"
—for John Frost, Grain Dealer Watkins, N. Y.

"Ash handling costs cut over $400 with this small hoist"
—for School of Industrial Art, Philadelphia.

"One man does work of four —$2,500 a year saved"
—for Fried-Long Leather Co., New York City.

"Speed and ease in transporting type forms"
—for McCrellish & Quigley, Trenton, N. J.

"Speed and safety in loading department store trucks"
—for Heipolsheimer Co., Grand Rapids, Mich.

Write for

Book of Illustrated Economies

It contains 68-pages of facts, figures and illustrations of how the LiftAbout is cutting handling costs in many industries.



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